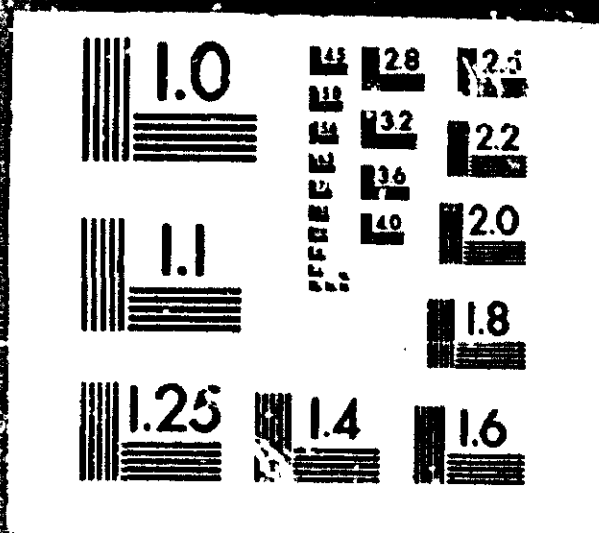


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**Safety Effectiveness Evaluation of the National Highway
Traffic Safety Administration's Rulemaking Process
Volume 2: Case History of Federal Motor Vehicle Safety
Standard 208: Occupant Crash Protection**

(U.S.) National Transportation Safety Board, Washington, DC

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NATIONAL TRANSPORTATION SAFETY BOARD

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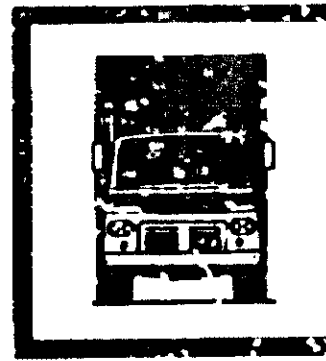
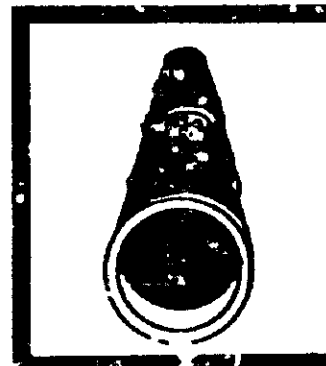
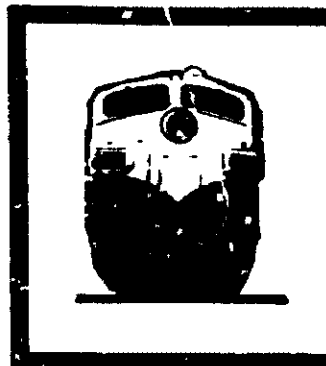
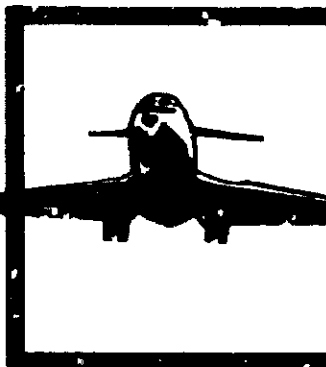
SAFETY EFFECTIVENESS EVALUATION OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S RULEMAKING PROCESS

**VOLUME 2 -- CASE HISTORY OF
FEDERAL MOTOR VEHICLE SAFETY
STANDARD 208: OCCUPANT CRASH PROTECTION**

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16. Abstract <p>This report is a case history of Federal Motor Vehicle Safety Standard (FMVSS) 208: Occupant Crash Protection. This regulation, promulgated by the National Highway Traffic Safety Administration (NHTSA), specifies injury criteria and testing procedures which must be met by vehicle restraint systems.</p> <p>The focus of FMVSS 208 has been the concept of passive, or automatic, restraint--protective devices which require no action on the part of the vehicle occupant. Rulemaking and associated activity concerning passive protection began in July 1969 and has continued to the present day. Mandatory passive restraint requirements are currently due to begin being phased in for passenger cars in September 1981.</p> <p>The standard has proven highly controversial, and much of the debate on the rule has centered around one particular type of passive restraint--the "air bag." The controversy has generated a large volume of material during the standard's 10-year history, including research and development studies, public hearings, Congressional review, dozens of evaluative reports, and two major court cases.</p> <p>The report describes the sequence of events associated with the development and implementation of FMVSS 208. It does not analyze or evaluate the technical adequacy of the rule. This case history will be used as a part of a subsequent safety effectiveness evaluation of the NHTSA rulemaking process which will be published in 1980.</p>					
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**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594**

Adopted: September 28, 1979

**SAFETY EFFECTIVENESS EVALUATION OF THE
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S
RULEMAKING PROCESS**

**VOL II: CASE HISTORY OF FEDERAL
MOTOR VEHICLE SAFETY STANDARD 208: OCCUPANT CRASH PROTECTION**

INTRODUCTION

The Independent Safety Board Act of 1974 directs the National Transportation Safety Board to "evaluate, assess the effectiveness, and publish the findings of the Board with respect to the transportation safety consciousness and efficacy in preventing accidents of other government agencies" The mandate is primarily fulfilled by conducting "safety effectiveness evaluations" of selected programs being administered by the various agencies.

The mission of the Safety Board is to analyze transportation accidents and the level of safety in various transportation systems to determine what can be done to improve transportation safety. The Board advocates the adoption of policies and regulations toward that end.

The Safety Board currently is conducting a safety effectiveness evaluation of the rulemaking process of the National Highway Traffic Safety Administration (NHTSA). The evaluation, which will be completed in 1980, will be based on case histories of the occupant crash protection standard, the air brake systems standard, and current rulemaking of the NHTSA, as well as the results of additional studies. The evaluation will respond to a request from the House Committee on Public Works and Transportation to conduct "an evaluation of the truck braking standards . . . and passive restraint systems." ^{1/}

This report is one of the case histories that the Safety Board will analyze in the safety effectiveness evaluation of the NHTSA rulemaking. It sets forth facts and the sequence of events associated with the promulgation by the NHTSA of Federal Motor Vehicle Safety Standard (FMVSS) 208, the standard which specifies occupant crash protection performance requirements.

The report is organized into three sections covering the years 1963 to 1972, 1973 to 1976, and 1977 to the present. Within each section topics such as rulemaking, Congressional action, litigation, and technological developments are described. A chronological presentation is dictated by the Safety Board's primary concern with the process and development over time of events associated with the

^{1/} U.S. House of Representatives, Report No. 95-1169, Part 1, p. 3.

passive restraint portions of FMVSS 208. The length of the rulemaking process in this case and the volume of material, however, necessitate some division of the data into categories. The reader is cautioned that, because of the actual chronology of events, description of some of the specific topics covered extends from one section to the next. Therefore, the final developments of a specific subject may be reported in a different section than the one in which the subject is introduced.

The case history was developed by the Safety Board through review of the NHTSA public dockets related to the standard's development, through review of the technical literature, and through a review of Congressional testimony and other related comment on FMVSS 208. In addition, numerous individuals from the biomechanical research community, the automotive industry, and Federal agencies were interviewed by the Safety Board. These interviews were used to supplement the data collected from documentary sources.

This case history of FMVSS 208 will not discuss the technical or legal aspects of the standard, per se. It is noted that there have been numerous formal and informal reviews of the standard. These include two major court tests (Chrysler Corporation v. DOT; and Pacific Legal Foundation v. DOT and Nader v. DOT), a major review in both Houses of Congress under the Congressional veto provisions of the 1974 amendments of the Safety Act, and a major review by the General Accounting Office. These reviews are discussed in appropriate sections of this case history.

BACKGROUND

The National Highway Safety Bureau (NHSB) was established on April 1, 1967, when two agencies in the Department of Commerce were merged and transferred to the newly created Department of Transportation (DOT). Within the DOT, the NHSB was placed under the Federal Highway Administration (FHWA). On March 20, 1970, the Secretary of Transportation separated the NHSB from the FHWA. Legislative action reorganized the agency effective December 31, 1970, renaming it the National Highway Traffic Safety Administration (NHTSA).^{2/}

The NHTSA issued FMVSS 208 under the authority of the National Traffic and Motor Vehicle Safety Act of 1966 (Safety Act of 1966. P.L. 89-563, September 9, 1966; 15 U.S.C. 1381 et. seq.). Congress had passed the Act, recognizing that motor vehicle crashes were by far the most serious cause of death and injury in the U.S. transportation system. Fatalities among passenger car occupants alone exceeded fatalities in all other transportation modes combined. In the Act, a Motor Vehicle Safety Standard was defined as "a minimum standard for motor vehicle performance, or motor vehicle equipment performance, which is practicable, which meets the need for motor vehicle safety and which provides objective criteria."

^{2/} Throughout this report, the agency will be referred to as the NHTSA.

In prescribing safety standards under the Act, the Secretary of Transportation was to

- (1) consider relevant available motor vehicle safety data, including the results of research, development and evaluation activities conducted pursuant to this [Act];

* * * *

- (3) consider whether any such proposed standard is reasonable, practicable and appropriate for the particular type of motor vehicle or item of motor vehicle equipment for which it is prescribed; and

- (4) consider the extent to which such standards will contribute to carrying out the purposes of the [Act].

In order to carry out this mandate, the Secretary was granted specific authority to conduct research, testing, development, and training in the field of motor vehicle safety.

One of the concerns expressed in the legislative history of the Act was that safety standards should set performance criteria and not be design-oriented regulations. The standards were expected to specify "the required minimum safe performance of vehicles, but not the manner in which the manufacturer is to achieve the specified performance. . . ." The intent was to insure that the safety standards allowed room for competition and did not "stifle innovation in automotive design."

FMVSS 208 entitled "Seat Belt Installations -- Passenger Cars" was issued as part of the "Initial Federal Motor Vehicle Safety Standards" on February 3, 1967. The regulation was accompanied by FMVSS 209: Seat Belt Assemblies--Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses, and FMVSS 210: Seat Belt Assembly Anchorages--Passenger Cars.

On July 2, 1969, an Advance Notice of Proposed Rulemaking (ANPRM) began a rulemaking process which was to establish a standard to supersede "Seat Belt Installations." The ANPRM, "Inflatable Occupant Restraint Systems," was followed on May 7, 1970, by a Notice of Proposed Rulemaking (NPRM), "Occupant Crash Protection; Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses." It is with this proposed standard and its development to the present that this case history is concerned.

The focus of FMVSS 208 as proposed in the 1969 and 1970 notices was a new concept in vehicle occupant crash protection--passive restraint. Passive, or automatic, restraint denoted a protective device "that require[d] no action other than would be required if the protective system were not present in the vehicle." It was contrasted directly to "active" systems, such as traditional safety belts, which, to be effective, required fastening by the vehicle occupant. Numerous

types of passive restraints had been conceived by inventors and private industry. Examples included static elements such as cushions or padded structural members, as well as more complex dynamic mechanisms such as blankets, nets, or shields which automatically swung into place when needed.

Early in its history, FMVSS 208 became associated with one particular type of passive restraint—the inflatable cushion, or "air bag" ^{3/} as it became popularly known. Debate soon began as to whether FMVSS 208, in effect, mandated air bags. The NHTSA repeatedly stated that the regulation was not directed toward air bags, and that any passive restraint which met the performance criteria set by the regulation was acceptable. Nonetheless, the development of FMVSS 208 and the evolution of the air bag have been closely related.

The idea of an inflatable bag which would protect automobile occupants during a crash is not new. However, the creation of a working air bag system involves the solution of a complex and interacting set of technological problems. An inflatable restraint system is composed of sensors for detecting a crash, a mechanism to rapidly generate gas or release stored gas in order to inflate the bag, the bag itself, and its storage compartments. Sensors must be reliable, yet capable of discriminating between a serious crash and low-speed impacts or routine shocks such as those caused by a rough driving surface. The gas, or a means of generating it, must be safely stored in the vehicle, and must be able to inflate the bag in the brief interval between the time a vehicle impacts an object and the time an occupant impacts the interior of the vehicle. The timing of bag deployment is thus critical. The bag must deploy to protect occupants ranging from children to adults, in vehicles ranging from subcompacts to luxury cars.

The air bag may be made of different materials fabricated in various configurations. It has been recognized that the air bag must not in itself present a hazard in deployment to a vehicle occupant, either a normally seated or out-of-position passenger; it should provide protection during multiple impacts, yet deflate quickly enough so as not to prevent safe, rapid escape from the vehicle after a crash.

In addition to the air bag technology, measuring devices must be developed so that passive restraint systems may be tested. Although some live human testing has been done, basic developmental work has been accomplished using instrumented anthropomorphic dummies. Other testing has been done using cadavers and animals.

To reproduce impact situations, vehicles may be crashed together under controlled conditions. Because of expense, however, other methods of simulating crashes have been developed. In a barrier test, a vehicle is crashed into a fixed barrier. Because such a barrier is unyielding, an impact into it at 30 mph approximates a crash where vehicles meet at a closing speed of 60 mph.

^{3/} The term "air bag" is used in the generic sense throughout the report. The reader is cautioned that there are many models of "air bags" and that those models have undergone evolutionary changes over the years.

Another type of simulated crash is the sled test. A frame, or sled resembling a vehicle body, is accelerated down a track and then stopped quickly. The test subject reacts as does a vehicle occupant in a crash, impacting against the sled "dashboard." The sled itself is undamaged. In another type of sled test, the sled is accelerated backward suddenly over a short distance, creating forces on test subjects similar to those experienced in other types of simulated crashes. All simulated crash testing using human surrogates is subject to the limitations of experimental testing. None reproduces exactly the forces or biomechanical effects experienced in real-world crashes.

I. FMVSS 208: 1969-1972

Early Development of Inflatable Restraints

The development of inflatable restraints for automobiles began in the early 1950's. J.W. Hetrick filed a patent in 1952 for an air cushion which automatically inflated when a vehicle suddenly decelerated. By 1955, several additional patents had been recorded. In 1957, Ford Motor Company (Ford) began work on the air bag concept and soon established that the major problems were development of an accurate sensing device, or trigger, for the system and the means for inflating the bag rapidly. By 1960, General Motors Corporation (GM) had begun developmental testing, and Martin Aircraft was starting research on air bag feasibility, presenting a review of this early testing at the 8th Stapp Car Crash Conference in 1964. 4/

In mid-1966, Eaton, Yale and Towne (Eaton), a supplier to the automobile industry, began a cooperative research and development effort with Ford. This work proceeded through 1967, and resulted in the conclusion that air bags could be activated automatically by a crash sensor and made to deploy in the 40-millisecond interval between initiation of a crash and the time when an occupant collides with the interior of the car. At the same time, tests were being conducted with live primates at Holloman Air Force Base. Nine simulated crashes using baboons and preinflated air bags produced only tentative results, but a test report concluded that air bags provided a significantly higher survival rate, at greater forces, than did belt and harness restraints. This was the first crash testing that indicated the injury-reducing potential of air bags. 5/

In early 1968, Ford and Eaton presented a technical paper reviewing their research at an annual meeting of the Society of Automotive Engineers (SAE). Forty-two tests had been conducted on a crash simulator, as well as one barrier test and the results had been promising. These early concept feasibility studies

4/ The Stapp Car Crash Conference is an annual symposium in which current research in car crash biomechanics is presented. The conference is named after John P. Stapp, M.D. (formerly Colonel USAF MC), an expert in crash testing and vehicle safety development.

5/ Richard G. Snyder, Joseph W. Young, Clyde C. Snow, "Experimental Impact Protection with Advanced Automotive Restraint Systems: Preliminary Primate Tests with Air Bag and Inertia Reel/Inverted-Y Yoke Harness," in Proceedings, 11th Stapp Car Crash Conference, University of California, 1967, pp. 271-280.

... showed possible levels of survivability unapproached by any other known restraint system and indicated that potential solutions to the many problems of applying this system to the high production automobile may be found. ^{6/}

However, the report cautiously advised that "implementation of a . . . restraint bag system in production automobiles will require intensive, long range development." Many problems remained to be solved, and the report explicitly noted several, including:

- o Establishing the effect of various human body sizes on impact results,
- o Establishing operational criteria for a crash sensor,
- o Demonstrating system reliability,
- o Developing an acceptable noise level.

The NHTSA first showed an interest in inflatable restraints in 1963. Eaton demonstrated its inflatable restraint concept to Dr. Robert Brenner, then Deputy Director of the NHTSA, and estimated that the system could be ready in 3 or 4 years. In July, Dr. William Haddon, NHTSA Director, met with representatives of GM, Ford, Chrysler Corporation, American Motors, and Eaton. Dr. Haddon indicated the NHTSA's interest in supporting accelerated development of air bag systems, acting as a "midwife" to the concept. Eaton, which had arranged the meeting, estimated a reduction in fatalities of 14,000 per year if air bags were used in front seating positions, 28,000 if used with lapbelts in all positions.

Discussion at the meeting centered around an agenda of four problem areas:

- (1) The effect of air bag deployment noise on the ear,
- (2) The effect of deployment pressure,
- (3) Correlation of dummy and human response,
- (4) Driver reaction to inadvertent firing of the system.

No specific solutions were offered, but Dr. Haddon urged further testing. Other problems were raised in the course of the discussion, including:

- o System effectiveness in angular impacts,
- o Vehicle occupants sliding off the sides of the bag,

^{6/} R.M. Kemmer, R. Chute, D.P. Hass, W.K. Slack, "Automotive Inflatable Restraint System," SAE Paper 680033, January 3-12, 1968, p. 9.

- o Prevention of deployment when a vehicle hits potholes or railroad tracks,
- o Possible hazard to vehicle occupants from deployment of the bag,
- o Dangers of stored, compressed gas in a vehicle,
- o Legal problems of introducing into the fleet a system tested only by experiment.

In spite of the problems identified, an auto company representative expressed moderate support for the potential of inflatable restraint systems. GM's Robert F. McLean summarized his company's position by saying,

I think in the case of this whole system, we are learning to fly. . . . I think we want to start with the rather basic simple system, very high in reliability, and get actual field experience and then exploit the apparent possibilities for further development. . . .

Research and development testing continued through 1968 and into 1969. The Highway Safety Research Institute (HSRI) at the University of Michigan, under contract to the NHTSA, initiated a study of air bag restraint systems. The HSRI followed this with a test program involving dummies restrained by air bags. The dummies were placed on sleds which were accelerated to speeds up to 30 mph and impacted in frontal collisions against barriers. Rapidly inflating air bags were used for all sled tests after June 1969. Tests were conducted both with and without lapbelts and provided the opportunity to study air bag restraining characteristics under controlled conditions. Meanwhile, the first sled tests using human volunteers were being conducted at Holloman Air Force Base. The HSRI project compared lapbelt to lapbelt-air bag protection, and indicated that the latter significantly reduced head and neck injury. ^{7/}

Eaton continued its development program, announcing that, in work with Ford, GM, Chrysler, and American Motors, its air bag system had been subjected to over 2 million miles of testing by 1969. In addition, other companies—Rocket Research, Niokol Corporation, and Volkswagen—began development work on air bags.

The First ANPRM

On July 2, 1969, an ANPRM entitled "Inflatable Occupant Restraint Systems" (Docket 69-07-Notice 1; 34 FR 11148) was published in the Federal Register. This ANPRM introduced two fundamental concepts for a new FMVSS 208: (1) "passive" or automatic restraints, those requiring no voluntary action by the user; and (2) inflatable restraints, or air bags.

^{7/} V.L. Roberts, J.H. McElhaney, D.H. Robbins, "Analysis of Daisy Track Human Tolerance Tests," University of Michigan, Highway Safety Research Institute, 1968 (DOT Report No. HS 800-498).

The purpose of the ANPRM was to indicate that the NHTSA was considering "requiring the installation of, and specifying performance requirements for, inflatable occupant restraint systems or other passive occupant restraint systems which provide comparable protection. . . ." The announcement noted that seatbelts, while proven effective, were used by only a small percentage of motorists. It described the air bag as "one very promising system, now in its final development stages . . ." adding that the National Motor Vehicle Safety Advisory Council had formally recommended that the DOT accelerate development of inflatable passive restraints. The ANPRM invited comments on inflatable or other passive restraint systems and listed particular areas of concern regarding which it hoped to receive comment. These included (quoting from the ANPRM):

- (1) Crash conditions under which the system should and should not deploy, e.g., deceleration levels and directions of impact.
- (2) Deployment and deflation times and positioning of the system components, when inflated, in relation to the vehicle interior and vehicle occupants.
- (3) Performance of the system in relation to the biomechanical characteristics of vehicle occupants, including recommended loads on the various portions of the human body, recommended noise and pressure levels, and other factors.
- (4) The extent to which existing Federal Motor Vehicle Safety Standards dealing with impact protection and occupant restraint should be changed to reflect the issuance of a standard requiring installation of passive restraint systems.
- (5) Design considerations such as reliability, maintenance, serviceability, environmental and other factors relating to the performance of such a system.
- (6) Cost consequences of a standard requiring such a system, and the earliest practicable dates on which motor vehicles can be equipped with inflatable or other passive occupant restraint systems.

The proposed effective date for a passive restraint regulation was January 1, 1972.

Response to the First ANPRM

First Public Meeting

On August 27 and 28, 1969, the NHTSA conducted a public meeting in order to

provide interested persons with a general orientation on the subject of inflatable passive restraints and . . . to give equipment suppliers, vehicle manufacturers, researchers and knowledgeable persons the opportunity to make formal presentations . . . and to exchange technical information. (34 FR 12107)

Participants represented four general categories of respondents:

1. Automotive component and equipment manufacturers, including Olin Mathieson Corp., Enterprise, Inc., Atlantic Refining Corp., Ensign Bickford Co., and Eaton. Papers presented by these contributors were supportive of air bag restraints but offered little supporting data. Eaton claimed that its "auto-ceptor" offered a "high level of occupant protection, store[d] completely out of sight, [was] automatically deployed, and offer[ed] maximum and practical protection for the unrestrained child."

2. Automotive vehicle manufacturers, including Chrysler, GM, Volkswagen, and Ford. In this category, papers presented data from research and testing and raised unsolved difficulties concerning inflatable restraints. Volkswagen limited its comments primarily to the "critical problem of lead time." While enthusiastically supporting the "potential benefits to be expected from a properly functioning air bag system," Volkswagen stated that because of the system's complexity, an "effective date of January 1972 is unrealistic, not feasible and not in the public interest."

GM also expressed reservations: "While the inflatable air cushion is an intriguing restraint device, we know of no reliable data from which to estimate the potential benefit of the air cushion in terms of lives saved and reduction of injuries. Also, it poses many engineering challenges."

Chrysler summarized its accomplishments and future aims for restraint development:

Chrysler Corporation is actively engaged in application of inflatable restraints on an accelerated basis. Inflatable restraints are extremely powerful, potentially hazardous devices. . . . Realization of the great safety potentials of the system, while minimizing the hazards and any other potential drawbacks calls for a thorough, sound engineering and manufacturing development program for car application.

3. Motoring organizations, including the American Safety Belt Council and the American Automobile Association (AAA). The comments made by the representatives of these two organizations were relatively neutral. They raised questions concerning inflatable restraints in hopes of stimulating continued research.

4. Interested and expert individuals, whose comments were varied—some supportive and some critical of air bag potential. Vernon Roberts, a research engineer with the HSRI, stated that the air bag was "not a panacea but it does have many desirable features. Given equal performance its passive nature is a significant plus. It provides distributed rather than localized loading and it may have other uses such as inflating headrests. We will not crusade for or against its implementation."

In both its introductory and closing comments at the public meeting, the NHTSA expressed a sense of the need for immediate action to reduce highway deaths. The agency stated that, charged with the task of reducing highway death and injury, and faced with low seatbelt usage rates, it considered the air bag "the most promising restraint system . . . seen to date." But the NHTSA's Robert Carter admitted that the agency had only limited data on the air bag. Dr. Brenner (NHTSA's Acting Director) explained the need for a systematic and comprehensive crash survivability research program, adding that there were "no short cuts to complete solutions."

Docket 69-07-Notice 1

Response to both the ANPRM and public meeting was collected in NHTSA Docket 69-07-Notice 1. Comment was offered by the major American auto companies and European manufacturers such as Peugeot, Citroen, Renault, and Rolls-Royce. Other respondents included Japan Automobile Manufacturers Association, the Automobile Manufacturers Association (U.S.), the American Medical Association, the AAA, Consumer's Union, and the American Safety Belt Council. In general, positions taken at the public meeting were restated. The comments expressed support for the potential of air bags, but virtually without exception they indicated that more testing was necessary and listed unresolved problems.

A letter from the Hamill Manufacturing Company (Hamill) (a division of Firestone Tire and Rubber Co.) objected to the title of the docket and ANPRM, "Inflatable Occupant Restraint Systems." Hamill was developing an automatic net which it felt offered the required protection for a passive restraint, and raised the question of whether the NHTSA was not in fact equating passive restraints and air bags.

The First NPRM

The first passive restraint proposal, "Occupant Crash Protection; Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses" was published as an NPRM on May 7, 1970. Its purpose was to "specify performance requirements for protection of vehicle occupants in crashes both by systems that do and those that do not require voluntary action" (35 FR 7187). It proposed replacing the existing FMVSS 208, "Seat Belt Installations," noting public resistance to the use of seatbelts and the consequent need for passive restraints. It labeled air bags "one of the most important recent technological developments in the field of crash protection," and mentioned such passive alternatives as deployable nets and extensive use of energy-absorbing materials. Like the ANPRM, the NPRM emphasized the need for all possible speed in developing and introducing passive protection. Because of the current highway death rate of 50,000 per year, the

notice claimed, "Any delay beyond the earliest possible dates by which basic protection can practically be provided would . . . be unconscionable." Finally, the NPRM announced a second public meeting to be held on June 24, 1970.

As required by the Safety Act of 1966, the proposed rule established levels for vehicle performance without regulating the specific design of a protection system. It did this by describing basic injury criteria which were expressed as maximum forces allowed on critical parts of the body. These forces were to be measured by an anthropomorphic testing dummy during specified types of test crashes. Thus, for example, the acceleration of the head could not exceed 80 g's⁸ for any continuous period of more than 3 milliseconds, the chest acceleration could not exceed 40 g's, and the force transmitted to the pelvis through the femur could not exceed 1,200 pounds.

Three types of crash tests were required:

- (1) A frontal crash, in which a vehicle impacted a fixed barrier head-on, or at any angle up to 30°, at 30 mph or less;
- (2) A lateral crash, in which a vehicle impacted a fixed barrier while moving laterally at 15 mph;
- (3) A rollover, in which a vehicle was subjected to two complete rollovers from a forward speed of between 30 and 60 mph.

In each of the three crash modes, the occupant was not to be ejected from the vehicle. The standard also established a minimum deployment speed of 10 mph to prevent needless activation of the passive restraint in low-speed crashes.

The specifications of the testing dummy were to be those recommended by the SAE. The NHTSA admitted that these specifications might "not provide totally reproducible results," but accepted them as "evidently the most complete set available at this time." A separate section of the proposed regulation described how the dummy was to be positioned in a test vehicle.

The NPRM of May 7, 1970, did not propose immediate passive protection. Recognizing the difficulties manufacturers might have in meeting the requirements, the NHTSA allowed two options between January 1, 1972, and January 1, 1973: (1) crash protection "by means that require no action by vehicle occupants," that is, passive restraints; or (2) active seatbelt systems of advanced design, as described in a separate section of the rule. After January 1, 1973, all passenger cars were to be required to offer full passive protection.

Finally, the NPRM recognized that relatively little developmental work had been done on passive restraints for multipurpose passenger vehicles, trucks, and buses. Light trucks and multipurpose passenger vehicles were given until January 1, 1974, to install passive protection; larger trucks were required only to have seatbelts after January 1, 1972, while buses were to have a safety belt for the driver after that same date.

⁸/ A "g" is a measurement of acceleration. One g is equal to the acceleration due to gravity, 32 ft/sec².

Response to the First NPRM

Shortly after publication of the NPRM a number of public conferences and meetings on passive restraints were held. At these, descriptions of passive protection state-of-the-art were presented, as well as comment on the newly proposed NHTSA rule. More formal and detailed responses to the NPRM were made to docket 69-07-Notice 4, primarily after the conclusion of the meetings in late June.

The NATO Conference

On May 11 and 12, 1970, the North Atlantic Treaty Organization (NATO) sponsored an "International Conference on Passive Restraints," which was hosted by GM at its proving ground in Milford, Michigan. Both DOT Secretary John Volpe and NHTSA Administrator Douglas Toms indicated that the reason for the conference, and the NPRM, was the Federal government's belief in the need for immediate and forceful action to reduce the "appalling death toll on the highways." Both expressed a sense of urgency. Echoing Dr. Brenner's concluding remarks at the public meeting of August 1969, Administrator Toms stated,

Our objective is to move as fast as we can, and to push as hard as we can. . . . [T]he question is: How fast can we cause this thing [implementation of passive restraints and reduction of highway deaths] to happen? I can assure you that we will force it to happen as soon as it is humanly possible.

Secretary Volpe in his opening remarks declared the purpose of the meeting to be the "sharing of technical data for air bags. . . . Our motto should be 'get the bugs out of the bags,' or whatever devices work best." Presentations included papers from the NHTSA, passive restraint component developers, and the major auto companies. Though the title of the conference indicated its subject was passive restraints, all reports presented dealt with air bags.

The NHTSA described a DOT Crash Survivability Program and a planned air bag field test program. The purpose of the latter would be to verify effectiveness and evaluate field reliability of air bag systems. The plan consisted of a four-phase program after test plan development: (1) 12 preliminary tests during the fall of 1970; (2) 60 crash tests during 1971; (3) pilot tests involving 750 retrofitted vehicles over a 5-year period beginning by January 1971, with monitoring at 6-month intervals; and (4) field tests, beginning by January 1972, over a 5-year period involving 12,500 vehicles.

Major automobile manufacturers described their progress in the research and development of inflatable restraint systems and commented on the NPRM. While all agreed much progress had been made, all voiced concern that adequate time was not being allowed by the proposed rule. A Nissan Corporation (Nissan) representative stated that ". . . although there are fair prospects for the development of each component [such as sensors, gas generator, bag, etc.], we

have not yet attained a performance level for the total system that would allow it to be used in a production vehicle." An American Motors representative declared that his company was "very concerned about the apparent haste in releasing to the public a product that we feel will require much more time for research and testing." Ford noted that it was "unaware of any vendor who [was] in a position to supply air bag devices from production tooling," and concluded its presentation declaring,

It is hoped that major progress with this [air bag] concept has been clearly shown to the point that it is possible to consider application to a future production vehicle. The hope also is that it has been made clear that there are many problems yet to be resolved, some of which could result in aborting any future vehicle program application.

GM's president Edward Cole had opened the NATO Conference stating: "We believe that the air cushion is technically feasible but there are many unresolved problems which exist between laboratory design and mass production reality." In summary remarks at the meeting's end he concluded that while great strides had been made, and while GM would aggressively pursue solutions to remaining difficulties, "it would be unrealistic to assume that the air cushion restraint system is now ready for mass production."

Second Public Meetings "Occupant Crash Protection"

The public meeting announced in the preamble of the May 7, 1970 NPRM was held in Washington, D.C. on June 24 and 25, 1970. Its purpose, like that of the first meeting, was to generate information on passive restraints. Those presenting papers at the conference were, in general, the same parties who had participated in the meeting of August 1969 and who had responded to the ANPRM in docket 69-07-Notice 1. Their comments at this second meeting addressed the proposed rule, passive restraints in general, and the NHTSA's treatment, via the NPRM, of their previous comments.

Most participants raised questions concerning inflatable restraint feasibility, some expressing strong disapproval of the NPRM. The International Mobile Air Conditioning Association stated, "We are now convinced that the air bag will not be in a state by 1974, let alone 1972, where its mandatory installation will be of net benefit to life and safety." Chrysler declared, "Based on our present knowledge we can give no assurance that the inflatable restraint concept will ever prove conducive to mass automobile production." American Motors said that the "timetable requiring passive restraints by January 1, 1973, is completely impractical [I]t is not a step forward when government regulations attempt to outrun technology."

Both Ford and GM, while again supporting the potential of air bags, expressed reservations concerning the NPRM, particularly the proposed timetable. Ford questioned the need for passive restraints, citing rising seatbelt usage rate, and estimated that it "is reasonable to expect a 60 percent belt usage could be achieved." Ford also questioned the practicability of requiring advanced seatbelt

systems for an interim period of a single year. The company requested that the NHTSA "clarify and quantify the reasons for requiring modification or elimination of current designs."

GM's paper outlined specific unresolved problems in air bag development and made recommendations to the NHTSA. The problem areas were: (1) air cushion inflation hazards, including ear damage, injury from air bag deployment, injury to out-of-position passengers, and possible loss of driver control; (2) air cushion protective limits in angular frontal, side, rear, rollover, and multiple-impact crashes; and (3) performance reliability, including monitoring the readiness of the system and the effect of environmental factors. However, GM remained "optimistic that suitable solutions [could] be found to most of [the problems] in a reasonable period of time." The paper then presented a specific timetable. Assuming no problems developed in a pilot program to be completed during 1972, GM proposed to offer air bags as an option in 150,000 model-year (MY) 1973 vehicles in September 1972. This would be followed by a million units in 1974 MY vehicles, the system becoming standard equipment on the lines on which it had been a 1973 MY option. Finally, by the fall of 1974, all GM 1975 MY passenger cars and light trucks would have passive protection as standard equipment.

The Center for Auto Safety wrote, ". . . January 1, 1973, is an entirely reasonable date for the switch over from the present system to the passive system. . . ." The Center called the automobile manufacturers' concerns for cost reduction "inexcusable, irresponsible and unconscionable if lives can be saved," and sharply criticized the manufacturers' positions. It called Ford's seatbelt usage estimate (60 percent) "wildly optimistic," GM's timetable "overinflated," and it dismissed Chrysler's presentation as "the least constructive contribution to the meeting."

In other papers, Professor L.M. Patrick of Wayne State University questioned the NPRM's interim seatbelt requirement and estimated, using current usage rates, that the cost to an occupant wearing such a belt system would be \$3,025. Charles Nixon, of the Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base, presented the findings of his work on the noise hazard of air bags. Using 91 test volunteers and air bag equipment from Baton, Nixon found no evidence of serious hazard, though he emphasized that his test results did not extend to infants or the elderly. While not conclusive, this study, contracted by the DOT, constituted the first evidence that the often cited fear of air bag noise might not be a serious problem.

In the final question-and-answer period, NHTSA officials acknowledged that uncertainties existed in some provisions of the NPRM, and asked that useful data be submitted to the dockets:

We know we have a lot of arguments about probably 90 percent of the material contained in this notice, but we're hopeful that people . . . will be making comments . . . in the spirit of cooperation and will not just say we can't do what you propose.

Concerning the data on which the NPRM was based or in answer to specific questions, NHTSA officials made the following statements:

- o On the rollover tests: "We realize that the rollover test is not consistent and repeatable."
- o On the establishment of injury criteria: After identifying areas of the body which were felt to be critical and concerning which it was believed measurements indicating human tolerance could be made, the problem was then "to establish levels for the tolerance based on the best data which was available. In some cases, the data was not available."
- o On the problem of inadvertent deployment and the legal consequences: "We don't know how big a problem this is going to be. So far we are still at zero."
- o Two questions were raised by Charles Nixon:
 - (1) How many accident investigations will be needed before a statistical conclusion on air bag effectiveness can be reached?
 - (2) If an improvement with air bag system cannot be shown, will [NHTSA] admit they have made a mistake and back down?
- o An NHTSA representative responded:

Well, I think its a little difficult to answer. . . . I'm sure I don't know at this point in time what type of data [or] how much data we would have to have to assure ourselves of the increase in the performance between a passive restraint and the existing belt."

Docket 69-07-Notice 4

The participants of the June public meeting filed formal comments to the NPRM of May 7, 1970, in Docket 69-07-Notice 4. Interested parties restated general positions on passive restraints and air bags, or asked for clarifications on specific sections of the proposed rule. In particular, aspects of the interim seatbelt requirements were questioned, such as locking and release mechanisms, and the specification that the system be operable with one hand. Other respondents expressed confusion over how the injury criteria for rollover and lateral crashes could be met without active belts.

Respondents also commented on the injury criteria used in the rule. Chrysler (United Kingdom) complained that "apart from the requirements of S.4.4.2 [head acceleration criteria] we know of no published data which could have been used as a basis for the injury criteria levels given in this section."

Ford's submission differed from the company's public meeting presentation in that a tentative implementation schedule was offered. Ford proposed a 2,000 to 4,000 car company fleet, with front seat protection, for 1972 MY; one line of vehicles with passive protection for 1973 MY; five additional lines in 1974 MY; and all lines in 1975 MY. However, in each case, passive protection was to remain an option rather than be installed as standard equipment.

A number of citizens wrote to the docket to register either support or disapproval of air bags. Responses were more or less equally divided for and against. One person who had seen an air bag demonstration on television wrote "to go on record as opposed to the proposal because I'm afraid of it." Those favoring air bags tended to express concern for the highway death toll and hostility to the automobile manufacturers.

The docket also included comments from the Congress. A letter signed by Senator Frank E. Moss and 20 other Senators, and the same letter signed by Representative Benjamin S. Rosenthal and 61 Representatives, urged Secretary Volpe to continue with the standard and to maintain the current timetable. The letter stated that the Congressmen understood the DOT had studied both the prospects and problems of air bags and had found that the system: (1) had high reliability, (2) would save at least 20,000 lives annually, and (3) though the proposed timetable put the auto industry under some pressure, the benefits far outweighed the short-term costs.

First Modification of the NPRM

On September 25, 1970, the NHTSA published Notice 6 (Docket 69-07-Notice 6; 35 FR 14941), a proposal modifying the May 7, 1970 NPRM. Changes specifically responded to comments made during the various summer meetings and to formal submissions to the docket. In particular, Notice 6 proposed new requirements for improved seatbelt systems to be installed before full passive protection, between January 1, 1972, and January 1, 1973. The proposed standard offered three options under which passenger car manufacturers could provide occupant crash protection during the year interim period:

- Option 1 — A passive protection system that requires no action by vehicle occupants. A variety of systems may be used to meet this requirement, among which are passive cushioning of the vehicle interior, self-fastening belt systems, crash deployed nets, "blankets," and air bags.
- Option 2 — A combined system that would require a Type 1 lap belt in all positions, and would either (1) be tested by a 30 m.p.h. barrier crash with anthropomorphic dummies restrained by lap belts in the front outboard seating positions, with the same injury criteria as the passive system; or (2) conform to the updated requirements proposed in notices of proposed amendment to Motor Vehicle Safety Standards No. 201 and 203 (35 F.R. 14936, 35 F.R. 14940).

- Option 3 — An improved combination of lap-and-shoulder belt system in the front outboard seating positions, with lap belts in other positions. The front outboard systems would be tested by a 30-mph crash in which the belt systems, used with test dummies would be required to remain intact.

If option 2 or 3 was chosen, the system was required, in addition, "to activate an audible and visible warning when either front outboard seating position [was] occupied and the belt [was] unused." An interlock system, which would prevent either starting or movement of the vehicle if seatbelts were not fastened, was specifically ruled out at this time. (For further discussion of the interlock, see pages 40-42.) The NHTSA explained,

A warning system, rather than one that prevents or interferes with vehicle operation, is preferred because the latter systems create safety problems of their own in certain situations, and are much more inconvenient in cases where vehicles are being moved in parking lots or into garages.

Other changes to the NPRM reflected NHTSA consideration of concerns generated by the May 7, 1970 notice. Some respondents had pointed out that

... an integrated three-point belt system may, in some vehicles, result in less belt usage than an assembly in which the upper torso portion is detachable, since some occupants who would normally use a lap belt would avoid using an integrated lap-shoulder belt.

As a result, Notice 6 proposed that the lap-shoulder belt combination required in option 3 could have a detachable upper-torso portion.

Some manufacturers had objected to the new safety belt requirements, arguing that "the cost of redesign and preparation for production would be unjustifiably high for our interim system." However, the NHTSA replied that, with the modifications proposed in the notice, "the cost of requiring interim improvements in belt systems can be justified."

Finally, some injury criteria were modified, though no explanation for the changes was given. For example, the maximum allowable head acceleration was changed from 80 to 90 g's, with a maximum of 67 g's permitted for intervals greater than 3 milliseconds; the allowable force transmitted to the pelvis through the femur was raised from 1,200 to 1,400 pounds.

Response to the Modification—Docket 69-07-Notice 6

Many comments to Notice 6 commended the NHTSA for its effort to consider a variety of positions and modify its rule accordingly. Chrysler wrote,

We appreciate that the [NHTSA] in this Notice has recognized some of the problems which we and others in the industry expressed in response to earlier notices.

Nevertheless, criticism of the proposed rule and the new changes continued.

Older arguments, such as the need for active belts to accompany passive restraints and the infeasibility of the January 1, 1973, deadline for passive protection, were reiterated. Objections to new requirements were raised, such as difficulties with the warning system and the continuous light/buzzer warning system. GM regarded both options 1 and 2 impossible to meet, had numerous questions concerning option 3, and wondered what basis the NHTSA had for believing that the belt system proposed in option 3 would be either more likely to be used or safer than current systems. GM officials met with NHTSA representatives on October 28, 1970, to ask these questions and arranged a second, higher level meeting at the GM training center on December 11, 1970, to further discuss seatbelt requirements.

In addition, the Safety Board responded to Notice 6 in a letter of November 2, 1970. The Safety Board supported the intent of the proposed standard, but pointed out that the various options, because they allowed different testing procedures, offered varying degrees and types of protection. The Safety Board recommended that

. . . the issuance of the proposed new Standard 208 for Occupant Crash Protection be accompanied by a clear statement of the protection assured by each option and sub-part of an option in terms of human body type, and various types of crash impact covered. Alternatively, an additional consumer information document should be initiated immediately to make clear to the prospective purchaser the various forms, grades, or classes of protection offered. The issuance of the final standard should also be accompanied by a statement concerning the existence of any harmful side effects of the various devices which meet the standard.

Finally, as the number of proposals, amendments, comments, and counter-comments began to increase, several parties expressed concern over the difficulty of responding fully and accurately to any particular proposal. The Automobile Manufacturers Association suggested that current FMVSS's 201, 203, 207, 209, and 210, as well as the proposed 208, were all related and needed to be integrated. The organization complained that there was too much to deal with and that comment periods were too short. Both the Center for Auto Safety and American Motors pointed out the difficulty of fully evaluating Notice 6, since it was indicated that further proposals and changes were likely in the future.

Notices of November 3, 1970

On November 3, 1970, the NHTSA published Notices 7 (35 FR 16927) and 8 (35FR 16937). Notice 7 constituted the first FMVSS 208 final rule and amended

certain aspects of the May 7, 1970 NPRM. Notice 8 was an NPRM. In both, the agency was responding to comments on its proposed passive protection regulation.

Notice 7

Notice 7 extended the date for mandatory introduction of passive crash protection in passenger cars from January 1, 1973, to July 1, 1973, and in light trucks and multipurpose passenger vehicles from January 1, 1974, to July 1, 1974.

Manufacturers had requested additional time "to conduct reliability and durability development programs for passive restraint systems, and to develop the necessary production tooling and techniques." The NHTSA concluded that while additional leadtime did seem needed, "the importance of passive protection is such that it would not be in the public interest to introduce it at the pace preferred by the slowest." As a result, a 6-month extension was adopted.

Continuing to emphasize the need for passive protection, the NHTSA responded to comments that it had "favored" or expected the introduction of air bag systems. The agency argued that

... while air bag systems are certainly one promising method of providing passive protection, it should be understood that other types of systems, such as fixed cushioning of the vehicle interior, self-fastening belt systems, and crash-deployed nets or blankets, used separately or in combination, are equally acceptable methods to the extent that they satisfy the requirements of the standard.

Notice 7 incorporated additional modifications in consideration of docket submittals. The requirement for a readiness indicator for crash deployment systems was clarified. A delay in implementation of passive protection in rear seats until July 1, 1974, was granted. The NHTSA commented that the delay had been found to be justified "in view of the additional development time that may be needed, since the occupancy rate for those seats is much lower, and they tend to be safer in a crash, than the front seats." The injury criteria proposed in notice 6 were adopted with the allowable head acceleration for intervals of greater than 3 milliseconds changed from 67 to 70 g's.

Other suggestions for amendment were denied. The NHTSA disagreed with proposals that active seatbelts should continue to be required with passive restraints, arguing that

... It is the [NHTSA's] position that the possible benefits of required seat belts would not justify the costs to the manufacturers and to the public. Only a small percentage of the public uses the upper torso restraints that are presently furnished with passenger cars. At high impact speeds, seat belts have been shown to reduce the effectiveness of air cushions in some instances.

Notice 8

Notice 8 proposed the following additional requirements to be contained in FMVSS 208:

1. Additional injury criteria for allowable accelerations of the head and chest in lateral crashes. Because human tolerance of lateral accelerations is less than in the frontal situation, the rule would lower permissible forces on head and chest to 40 g's and 20 g's, respectively, for lateral impacts;
2. A moving barrier test in the lateral crash mode, to replace a fixed barrier test proposed in the May 7 notice. A moving barrier would impact a fixed vehicle at 20 mph, a speed calculated to approximate the formerly proposed test of a moving vehicle impacting a fixed barrier at 15 mph;
3. A procedure for rollover testing;
4. Cancellation of a formerly included exception to the rollover test for open-type light trucks and multipurpose passenger vehicles;
5. A minimum vehicle speed of 15 mph for actuation of crash-deployed protection systems.

FMVSS 208 Notice 9: The First Complete Rule

On March 10, 1971, the NHTSA published a complete final rule, Notice 9 (36 FR 4600), which "establish[ed] quantitative criteria for occupant injury, as determined by use of anthropomorphic test devices," and set a timetable for implementation of the rule. For vehicles manufactured between January 1972 and August 15, 1973 automobile makers were given three options for crash protection; between August 15, 1973 and August 15, 1975, a set of two options was provided; after August 15, 1975, full passive protection for all seating positions would be required in all passenger cars. A separate timetable and requirements applied to trucks and buses.

Although there had been many requests for a postponement of the effective date, the NHTSA determined that compliance by January 1, 1972, with one of the three available options was "reasonable and practicable," though certain changes were incorporated in view of the comments. The options were as follows:

- Option 1 — Complete passive protection, meeting all injury criteria in all crash modes (frontal, lateral, and rollover) in all occupant seating positions.
- Option 2 — Lap belts installed in all seating positions; front outboard seating restraints capable of meeting the injury criteria in a 30-mph, perpendicular barrier crash.

- Option 3 -- Combination lap and shoulder belts at front outboard seating positions, with lap belts at all other positions; front outboard seating restraint capable of withstanding a 30-mph, frontal barrier crash without belt or anchorage failure.

Both the second and third options required warning systems that activated a visible and audible signal if an occupant of either front outboard seat had not extended the lap belt to a specified length.

Virtually every petition for reconsideration filed in response to Notice 7 requested that the requirements for mandatory passive protection be postponed. With the minor exception of extending the effective date 1 month from July 15 to August 15, 1973, however, the NHTSA denied these petitions, offering the following explanation:

The petitions did not offer sufficient reasons to change the Administration's position, as set forth in previous notices in this docket, that passive protection systems are a vitally important step in reducing the death and injury toll on our highways, and that the relevant technology is sufficiently advanced to provide this basic protection, in accordance with the performance requirements and the time schedule that have been specified. The petitions that requested a postponement of all passive protection requirements beyond August 15, 1973, are therefore denied.

The NHTSA did realize that the passive restraint development for the various impact modes had not progressed at an equal pace. In view of this, two options were made available for front seating protection between August 15, 1973, and August 15, 1975:

- Option 1 -- Total passive protection for all occupant seating positions in all crash modes.
- Option 2 -- Passive protection for front seating occupants in a head-on collision, with a lap belt at each seating position and a warning system for front seat outboard position belts. Injury criteria would have to be met at the front seating positions both with and without the lap belts fastened in a perpendicular frontal fixed-barrier crash.

Passive protection in side impact crashes was postponed to August 15, 1975, in order to allow additional leadtime necessary to develop such systems. After August 15, 1975, all passenger cars would be required to provide passive protection for all seating in all impact modes.

Minor modifications were made to the injury criteria. Objections had been raised to the head acceleration requirement, considered by many to be too conservative. A severity index of 1,000, described in the SAE Information Report J885(a) (June 1966), had been proposed as a more appropriate alternative,

and was adopted by the NHTSA. Petitioners objected further to the NHTSA's use of anthropomorphic test devices as described in SAE Recommended Practice J963 (June 1968). Respondents reiterated the essential need for further specification to insure repeatability of test results. The agency repeated its position, however, that it "finds no sufficient reason to alter its conclusion that the SAE specification is the best available."

Rulemaking, July 1971 - November 1972, Notices 10-25

Notice 9, of March 10, 1971, attempted to finalize FMVSS 208, taking into account responses generated by Notice 4 (May 7, 1971), Notice 6 (September 25, 1970), Notice 7 (November 3, 1970), and Notice 8 (November 3, 1970). It did not, however, constitute an end to amendment and modification of the rule. Petitions for reconsideration, as well as lengthy comment on FMVSS 208, were immediately submitted to docket 69-07-Notice 9. Furthermore, Chrysler requested a review of the standard by the U.S. Court of Appeals for the Sixth Circuit. This began the proceedings of the Chrysler case, on which the court finally ruled on December 5, 1972. (The case is discussed on pages 33-37 of this report.)

Between March 1971 and December 1972 the NHTSA continued to publish notices modifying FMVSS 208. Most of the modifications responded to docket comments on previous versions of the standard. Thus, Notices 10, 12, 13, and 14 addressed responses to Notice 9; Notice 15 addressed comments on Notice 10; and Notice 16 addressed comments on Notices 12 and 13.

On May 4, 1971, Administrator Toms published a clarification of the term "passive systems." In particular, he responded to questions as to whether systems that required occupants to take protective action before entering or starting a vehicle (that is, interlock systems) could be classified as passive. Toms defined a passive system as one "that requires no action other than would be required if the protective system were not present in the vehicle" (36 FR 8296). Seatbelt interlock systems were thus specifically excluded as passive protection.

On July 8, 1971, modification of the March 10, 1971 rule began with the publication of Notices 10 and 11 (36 FR 12858, 12866). The former adjusted certain aspects of the seatbelt warning specification, including the addition of a 1-minute minimum activation period. Also, the NHTSA addressed the concept of passive belts in Notice 10, acknowledging the need for interpretation of the standard's seatbelt specifications in the light of passive belt development. Questions had been raised, for example, as to whether a passive belt must conform to the adjustment, latching, and warning system requirements applicable to active belts. The NHTSA added a passive belt assemblies paragraph to the standard, and clarified which active belt specifications applied to passive belt systems.

Notice 11, also published on July 8, 1971, proposed "to establish requirements for the release of passive restraints." The NHTSA wished to insure that vehicle occupants could free themselves from the restraint system after a crash.

Notice 12, published on October 1, 1971 (36 FR 19254), addressed numerous petitions submitted to docket 69-07-Notice 9. Minor modifications to the standard dealt with the readiness indicator, the weight at which vehicles should be tested, and the placement of testing dummies. The NHTSA again discussed the problem of the testing dummy. The agency acknowledged complaints of its inadequacy, but concluded that freezing its design would "not . . . appear to be desirable at this time." Development on the dummy was continuing, and further amendments concerning its specifications could be expected. The NHTSA added that manufacturers need not fear that test result differences due to dummy variance would be used as a basis for charges of noncompliance. The NHTSA declared that it did not intend "that a manufacturer's status with respect to compliance [would] be jeopardized by possible variances in test dummies permitted by the present set of specifications."

Notice 13, also published on October 1, 1971 (36 FR 19266), proposed a major change to FMVSS 208. It announced that a seatbelt ignition interlock system would be permitted during the interim period between August 15, 1973, and August 15, 1975. An interlock system would prevent a vehicle from starting if a front-seat occupant neglected to fasten his or her safety belt. The NHTSA's stated purpose in proposing this option was "to provide a high level of seatbelt usage and to increase the life- and injury-saving effectiveness of installed belt systems, in the interim period before passive systems are required."

Notice 14, published on October 9, 1971 (36 FR 19705), proposed to establish requirements for explosive devices and pressure vessels used in occupant restraint systems. Notice 14 provided that any such devices must conform to applicable DOT hazardous materials regulations.

On December 14, 1971, the NHTSA published Notice 15 (36 FR 23725) which addressed petitions responding to Notice 10 of July 8, 1971. A number of requests to modify aspects of the warning system regulations were denied. In addition, the Japan Automobile Manufacturers Association request that passive belt assemblies be exempt from FMVSS 208 was granted.

Notice 16, published on February 24, 1972 (37 FR 3911), put into final form, with only minor modifications, the amendments proposed in Notice 13 with respect to seatbelt interlock systems. These were to be allowed during the period August 1973 to August 1975. A request by the Center for Auto Safety to institute this timetable 1 year earlier was denied, as were suggestions that the interlock system be restricted to the driver or to front outboard seating positions only.

The next NPRM (Notice 17), published on March 16, 1972 (37 FR 5507), proposed to amend the head injury criteria of FMVSS 208. A May 6, 1972 notice (Notice 18; 37 FR 9222) adopted the proposals advanced in Notice 14 concerning pressure vessels and explosive devices. Notice 19 (June 23, 1972; 37 FR 12393) adopted the method of calculating head injury criteria proposed in Notice 17 and responded to petitions generated by Notice 16. In particular, head injury measurements for seatbelt systems were modified for automobiles manufactured before August 15, 1975.

Petitions for reconsideration of the seatbelt interlock requirements (Notice 16) were considered in Notice 20, published on July 6, 1972 (37 FR 13265). For the most part the final rule was the same as the proposed rule, though minor amendments were made. Petitions to extend the interlock option indefinitely, thereby replacing passive protection, were denied. Notice 21 (August 17, 1972; 37 FR 16604) denied petitions requesting reconsideration of requirements pertaining to pressure vessels and explosive devices (Notice 10). Notice 22 (August 11, 1972; 37 FR 16186) specified January 1, 1973, rather than 180 days after publication in the Federal Register, as the effective date for the amendment made to FMVSS 208 in Notice 20.

An October notice (Notice 23, October 26, 1972; 37 FR 22871) responded to petitions regarding injury criteria for seatbelts in vehicles manufactured after August 15, 1973. Later, Notice 24 (October 28, 1972; 37 FR 23115) proposed amendments to femur and chest injury criteria for vehicles manufactured before August 15, 1975. The modification would raise the maximum permissible load on the femur from 1,400 to 1,700 lbs, and substitute a severity index of 1,000 for the chest injury criterion to replace the older 60-g, 3-millisecond limit. Finally, Notice 25 (November 23, 1972; 37 FR 24903) issued the chest and femur injury criteria proposed in Notice 24.

Technological Developments and Testing, 1970-1972

During the period 1970 to 1972, research, development, and testing of passive restraints proceeded concurrently with NHTSA rulemaking. 9/

Passive Restraint Alternatives

Between 1970 and 1972, a variety of passive restraint systems were developed. Both Hamill and Nissan developed and tested net systems which deployed from the ceiling upon vehicle impact. Passive belts were being developed by Volkswagen and others. Eight papers read at the 2nd International Conference on Passive Restraints, held in Detroit in May 1972, described developments in passive belts. 10/

Other passive system ideas included either permanent or flexible transparent shields, such as a device developed by Sobkow and Grenier for Ford; deploying blankets such as the Firestone "Security Blanket," developed to protect rear-seat occupants; static cushions, or cushioning materials; and arms and barriers, including a torso restraint, designed to swing into place as the door was closed, which was developed by Minicars, Inc., for the NHTSA.

9/ The reports described in this and other sections on technology and testing are noted to illustrate the type of research and development undertaken by the NHTSA. A detailed review and analysis of the research and development program related to FMVSS 208 is being conducted by the Safety Board and will be integrated into the final Safety Board evaluation of the NHTSA's rulemaking process.

10/ See R.G. Snyder, Advanced Techniques in Crash Impact Protection and Emergency Egress from Air Transport Aircraft, NATO, AGARD Report No. 221 (June 1976), pp. 78-87; see also bibliography, p. 179 ff.

Air Bag Development

Research and testing were initiated between 1970 and 1972 to develop inflatable restraint technology and to test the capabilities of the system. Considerable work went into development of the components of the system. Research into air bag design included bag size and shape, material, and use of vents. Tests in 1971, for example, indicated unacceptable rebound characteristics in early air bag systems. Studies of air bag material in 1972 helped reduce these difficulties. 11/ Development and testing of multiple-cell air bags found this design to perform better in multiple collision and oblique-angle frontal impacts. 12/ In addition, a Cornell Aeronautical Laboratory project sponsored by the NHTSA began development of an inflatable restraint system for rear seat occupants. 13/ Crash sensors also underwent extensive development. By 1971, both Eaton and GM had produced commercially available sensing units, which were evaluated and compared by the HSRI at the University of Michigan under NHTSA sponsorship. 14/ Another 1971 study identified two promising new systems, using microwave radar and ultrasonic sensors. Also in 1971, work on gas generation and its diffusion into the air bag continued. HSRI tests with diffusers demonstrated that the initial velocity of the deploying bag could be reduced, thereby lessening what had been a potentially dangerous force loading on an occupant, particularly an out-of-position passenger.

In the fall of 1970, the NHTSA began its preliminary crash testing program, as announced at the House Appropriations Subcommittee hearing in April 1970 and at the NATO conference in May 1970. A set of 12 crash tests, conducted by Cornell Aeronautical Lab, showed that air bags significantly reduced head and chest accelerations. However, femur and pelvic loadings were not significantly alleviated by the presence of air bags. 15/

A number of human volunteer tests were conducted between November 1970 and August 1971, including the first dynamic tests exposing subjects to rapidly inflating air bag restraints. A report summarizing these tests concluded,

11/ E.H. Klove, and R.N. Oglesby, "Special Problems and Considerations in the Development of Air Cushion Restraint Systems," Proceedings, 2nd International Conference on Passive Restraints, Society of Automotive Engineers, Paper No. 720411, 1972.

12/ N.E. Shoemaker, "Research and Development of an Advanced Inflatable Occupant Restraint System, Final Report," Cornell Aeronautical Lab., Inc., 1971.

13/ R.A. Rose, and D.J. Romeo, "Development of a Rear Seat Inflatable Occupant Restraint," Cornell Aeronautical Lab., Inc., 1972 (DOT Contract HS-053-1-168).

14/ D.H. Robbins, A.W. Henke, V.L. Roberts, "Impact Sled Studies of Right Front Passenger Inflating Restraint Systems," HSRI, University of Michigan, May 1971 (DOT Contract FH-11-6962).

15/ J.F. Martin, D.J. Romeo, "Preliminary Vehicle Tests - Inflatable Occupant Restraint Systems," Cornell Aeronautical Lab., Inc., 1972 (DOT Contract FH-11-7621).

The lap belt plus air bag invariably lowered both the impulse and peak force loading to the pelvis when compared to the lap belt only . . . [The air bag's] use with the lap belt will greatly reduce the fatalities and trauma resulting from automobile frontal impact. 16/

However, these tests failed in their objective to reach acceptable subjective tolerance levels.

Static tests conducted in 1971 studied the effects of deployment on subjects seated in a variety of positions. Results showed that the explosive inflation of the bag disturbed the test subjects' ability to perform a simple behavioral task for up to 4 seconds. A review of tests that same year using GM "production" air cushions, found that problems with the system included rebound, high head acceleration, hyperextension of the knees, and induced lateral head rotation. 17/

Another HSRI study compared sled tests to actual car crash results and found poor correlation between the two. This report indicated difficulties in extrapolating from sled tests to prediction of real-world injury reduction potential, thus casting doubt on the validity of testing programs. 18/

Also, testing on inflatable restraint noise was done from 1970 to 1972, indicating that further research was necessary. Regarding the former, Charles Nixon's 1969 study, "Human Auditory Response to an Air Bag Inflation Noise," had tentatively suggested that air bag noise did not cause hearing damage. However, a comprehensive study contracted by the NHTSA in 1970 estimated that exposure to a full complement of vehicle air bags, inflated simultaneously, could lead to hearing damage in 15 to 30 percent of the exposed occupants. 19/

Effectiveness Evaluations of Passive Restraints

NHTSA Safety Benefits Report

In January 1971, the NHTSA produced a report entitled "Safety Benefits of the Occupant Crash Protection Standard." In this study, Conrad Cooke, an NHTSA systems analyst, estimated the safety benefits of FMVSS 208 as published in Notice 7 (November 3, 1970), using past accident data and engineering judgments. Assuming 100-percent implementation of the standard, the report concluded that 5,720 lives would be saved, and 423,000 injuries prevented.

16/ Gragg, Bendixon, Clarke, Kloffenstein, Sprouffske, "Evaluation of the Lap Belt, Air Bag, and Air Force Restraint Systems During Impact with Living Human Sled Subjects," Proceedings, 14th Stapp Car Crash Conference, University of Michigan, 1970, pp. 261-262.

17/ See Snyder, Advanced Techniques, p. 104 for bibliographical references.

18/ J.H. McElhaney, D.H. Robbins, A.W. Henke, V.L. Roberts, "Car Crash Tests. Final Report," HSRI, University of Michigan, 1971 (DOT Contract FH-11-6962).

19/ C.H. Allen, R.D. Bruce, C.W. Dietrich, and K.S. Pearsons, "Noise and Inflatable Restraint Systems," Bolt, Beranek, and Newman, Inc., Report No. 2020, Sept. 1970 (DOT Contract HS-006-1-006). See also Snyder, p. 187 for bibliography.

The study also cited factors which would tend to reduce the effectiveness of inflatable restraint systems. It was suggested that test barriers might not result in crashes representative of the real world; that the effectiveness of the system was sensitive to occupant location in the vehicle; that effectiveness varied with direction of impact; and that the human tolerance criteria used in the testing specifications did not preclude other types of injury. The report also cautioned that psychological reactions to safety devices could produce effects of unknown magnitude, and that, "in view of the sensitivity of adverse consequences, psychological effects of standards should be considered at least qualitatively at present, and some attempt should be made to develop specific correlations in the future" [emphasis in original].

The study recommended that changes be made to the proposed standard to minimize the impact of some of these factors. The following recommendations were made (quoting from the report):

- a. Test Speeds. A plan should be developed and its schedule announced for progressively increasing test speeds in 10 mph increments to at least 50 mph at reasonable time intervals (such as 2 years).
- b. Impact Direction. The plan should include a method of insuring more universal protection with respect to impact direction variables. This should include:
 - (1) An oblique side impact by corner of barrier in the first (progressive) amendment.
 - (2) A narrow front barrier offset to the left to simulate impact with a typical roadside hazard, or partial evasion of head-on collisions (as part of the second step in the program).
- c. Barrier Characteristics. In addition to the narrow barrier above, b(2), the vertical contour and resiliency of barriers must be upgraded to effectively preclude vehicle susceptibility to underride/override. . . .
- d. Occupant Mislocation. The presumption that occupants are perfectly positioned at impact is not valid and encourages design and compliance of protection systems which depend upon working space that is unavailable to inattentive passengers in real accidents, where evasive maneuvers or successive impacts frequently occur. This is an inherent problem of deployable systems which may not be solved, at best, until the second generation. . . .
- e. Human Tolerances. The present standard legally permits a simulated occupant to be crushed, pierced, decapitated, subjected to fatal abdominal pressure during impacts, or subjected to sustained pressure thereafter.
 - (1) Human tolerance criteria should be extended to require adequate contact area on head or torso during peak accelerations currently specified so that pressures will remain tolerable.

- (2) Side-by-Side Manikins should be required in both outboard forward seating positions during the side collision test to require adequate protection for unrestrained occupants with respect to cross vehicle motion, inter-occupant impact, and stacking loads. . . .

The RECAT Study

On February 28, 1972, the Ad Hoc Committee on the Cumulative Regulatory Effects on the Cost of Automotive Transportation (RECAT) published a final report for the Office of Science and Technology. ^{20/} This report, in part, combined both a comprehensive review of existing occupant restraint literature and a review of responses solicited from automotive manufacturers, recognized experts, and authorities. Drawing from these data, two major restraint systems were discussed: the air bag, and the 3-point harness, or advanced lap-shoulder belt ensemble.

The RECAT Committee analysis of the costs and benefits of both the air bag and the 3-point harness were summarized. "Optimistic" estimates showed the air bag less effective than a properly used harness. In addition, the air bag system would benefit only slightly more than its cost, its benefits being equal to those for 80-percent harness utilization. Using "pessimistic" estimates, the air bag benefited far less than its cost and its benefits were found to be about equal to 33-percent use of the harness. The committee concluded that

the air bag cost is substantially higher, and the predicted benefit is no greater, than the corresponding cost and benefit of the well-known, time-tested, 3-point harness system.

In assessing the technical feasibility as well as the safety and reliability potentials of the two systems, the committee found that the 3-point harness effectiveness was statistically proven by hard data, ^{21/} but low usage rates considerably offset their benefit. Additionally, there was "inadequate data on the effects of improved convenience, warnings and interlocks." In summary, the committee said,

There remain today uncertainties about the feasibility, benefits and hazards of the air bags, as well as about the extent to which harnesses will be utilized in the future. Both the air bag and seat-belt restraint systems represent expanding technologies.

^{20/} The Office of Science and Technology advised and assisted the President in insuring that science and technology were being used in the interests of the general welfare. It was abolished and its functions transferred to the National Science Foundation in June 1973.

^{21/} N.I. Bohlin, A.B. Volovo, "A Statistical Analysis of 28,000 Accident Cases with Emphasis on Occupant Restraint Value," in Proceedings, 11th Stapp Car Crash Conference, University of California, October 1967.

The consequences of these uncertainties were considered pertinent to the NHTSA's occupant restraint rulemaking policy. The committee declared,

Much of the rancor stirred by FMVSS 208 . . . came about because the decision to require passive restraints was made in the absence of adequate hard information as to technical feasibility, potential hazards, expected safety benefits, cost, and the relative merits of existing restraint systems.

On a broader scale, the committee criticized the NHTSA for promulgating an "overly narrow performance standard" without a comprehensive assessment of potential effects. While authorizing any passive system which would meet the performance specifications, FMVSS 208 did not require the system to meet any specific reliability standard, nor did it require it to be free of potentially hazardous effects. The committee's report stated,

NHTSA has taken the position that, if the automotive companies incorporate a device which is in compliance with the performance requirement of certain standards but is inadequately reliable or otherwise hazardous, the public will exercise its right of recovery through the courts or under the warranty.

The committee believed that a regulatory philosophy of this sort was unsound because it arbitrarily limited the agency's cost-benefit analysis and it could destroy public confidence in the soundness of the regulatory agency. Instead, it was recommended that a "fly before buy" philosophy be adopted by the NHTSA. That is, hard statistical evidence should be available which indicated that all of the obvious first-order problems had been solved and that air bag-related regulations assured the motoring public of a) safety, b) system reliability, and c) protection against potential hazards.

Congressional Hearings and Other Response to FMVSS 208

Congressional Hearings

Passive restraints were discussed at Congressional Appropriations Subcommittee hearings from 1970 to 1972. The House Appropriations Subcommittee expressed particular interest, questioning Administrator Toms on FMVSS 208 in the course of testimony on the NHTSA's budget requests.

In the April 1970 House hearing, Toms defended the NHTSA's estimate that 20,000 lives per year could be saved with the installation of air bag restraint systems. He indicated that the NHTSA had considered nets, arms, and other passive restraint possibilities, but had found air bags "to offer the greatest

feasibility and some of the greatest reliability." 22/ Toms stated that of the \$3.2 million requested for the NHTSA's "Occupant Packaging" program for fiscal year (FY) 1971, \$1.95 million was for air bag-related projects. In FY 1970, the NHTSA had designated \$1.345 million for air bag research and development, up from \$100,000 in FY 1969.

Toms also submitted for the record the NHTSA's schedule for an air bag testing program. Crash testing was to continue through 1971; field testing of a 500-vehicle fleet was to take place between July 1970 and 1975; and 12,500 vehicles were to be field-tested between July 1971 and 1976. This schedule, he indicated, was "geared toward supporting an effective date of January 1, 1972 [that proposed in the ANPRM of July 2, 1969]...."

In the spring of 1971, the same House Subcommittee questioned the NHTSA again on air bags. Toms was asked to comment on the suit filed against the NHTSA by Chrysler. He speculated that having to meet the standard in all vehicles in 1 year was proving difficult for the automobile industry, and that "the suit might be trying to bide them some time." 23/ Toms said he welcomed a judicial review, and believed it would show "that the Government has done its work carefully and our position is sound and that these requirements are reasonable."

In answering other questions from committee members, Toms emphasized the reliability of air bag systems, declaring that Eaton had said categorically that "failures are literally nonexistent." He estimated the cost of replacing an air bag at about \$100. The committee chairman, Representative John McFall, asked, "How does this standard relate to the air bag? How much did you spend on tests prior to issuing the standard and how much of that amount was spent on testing the air bag?" Toms replied, "At the end of this fiscal year [FY 1971], approximately \$3.57 million will have been spent in the field of restraint development. Of this total, approximately \$1.49 million will have been spent on air bag research and development." Later in the hearing this figure was raised to \$2 to \$3 million or more, when in-house staff expenses related to air bag development were added to commercial contract costs.

In the 1972 hearings, more extensive questions concerning air bags were asked of Toms. Representative Silvio Conte asked him to respond to charges that the NHTSA had given in to the automobile industry in delaying the passive restraint effective date until August 15, 1975. Toms replied that because testing was not proceeding as rapidly as had been hoped, and because production difficulties had arisen, the agency had determined that "it was in the public interest to delay the installation time period."

22/ Hearings Before a Subcommittee of the Committee on Appropriations of the House of Representatives, 91st Congress, 2nd Session, Part 3 (Washington 1970), p. 205.

23/ Hearings Before a Subcommittee of the Committee on Appropriations [of the] House of Representatives, 92nd Congress, First Session, Part 3, (Washington, 1971), p. 24.

Toms was also questioned about the relative effectiveness of seatbelts and air bags in side and rollover crashes. He replied,

[In side crashes] seat belts don't do any better than air bags. You don't want to be held in position in a side crash, particularly if the other car is going to intrude into your space. You want to be moved across the vehicle and out of the way of the striking car. . . . In [the rollover] case, we don't find people die in rollover crashes. If you have to be in a crash, the safest kind of crash is a rollover. . . . This is not a serious consideration for restraint. . . .

In addition, Representative Conte noted questions concerning air bags which had been raised by the RECAT study. Toms defended air bags, stating that they provided better lifesaving protection at higher speeds than belt or harness systems.
24/

The NHTSA authorization hearings before the House Subcommittee on Commerce and Finance in June 1972 also covered some aspects of the FMVSS 208 program. The NHTSA program was summarized by Toms as follows:

We are continuing our efforts in the field of occupant packaging. Our research is examining ways to improve the passenger protection capability of current air cushion systems as well as examining other promising passive restraint systems including passive seatbelts. We are conducting a program to fleet test production air cushions on the road. This program will extend our knowledge on air cushion maintainability and demonstrate the system's reliability under all conditions.

Expanding on this subject before the Senate Committee on Commerce in that same month, Toms stated,

I think that most of the world's highway safety experts agree that most people have not been using their seatbelts and that the publicity campaigns or public information campaigns have failed to increase seatbelt usage significantly. . . . We feel the air bag has the greatest life-saving potential of the current passive restraint systems. We recognize that there might be difficulties with the production of the air bag system. However, we believe that it will probably do a better job than any device that we know of today. . . . Knowing this, and recognizing the air bag's lifesaving potential, we feel obligated to do whatever we can to have the air bag used for the public's benefit.

24/ Hearings Before A Subcommittee of the Committee on Appropriations [of the House of Representatives, 93rd Congress, (Washington, 1972), pp 935-1020.

Other Response to FMVSS 208

Early in its history, FMVSS 208, and the air bag in particular, became the subject of critical comment in newspapers and magazines. In August 1969, for example, the New York Times published an article which described the air bag as the "most painful automatic safety device ever developed." The air bag was reported to "slug into the face, stomach, groin and thigh with the force of a powerful fist," leaving cuts and bruises on volunteers.

An article in Parade Magazine in June 1971 emphasized numerous uncertainties concerning the air bag system. During air bag laboratory testing, it reported, "test dummies [had] been blown out windows, doors had been bent, instrument panels smashed." In addition, the automobile industry advertised "a catalogue of possible perils to passengers." Henry Ford was quoted as calling the air bag "a lot of baloney."

Other articles commented on what was called the government's haste in implementing inflatable restraints. In "When Politics and Safety Mix: The Selling of the Air Bag" (November 1972), the AAA criticized the government's "air-bags-NOW campaign" as being marked by a "lack of conclusive research and testing to document air bag efficacy, conjecture based upon incomplete facts, misleading statements and inadequate disclosure of test results." The AAA maintained that the air bag was being "irresponsibly and prematurely sold" to the public. The American Safety Belt Council stated it did not oppose air bags, but believed that they "should be subjected to rigorous real-world evaluation before being mandated on all cars."

In addition, air bags failed in several public demonstrations, and these were reported by the press. For example, during the NHTSA's first public hearing on inflatable passive restraints in August 1969, Ford sponsored a static air bag test. All three attempts to activate the bag failed. On March 31, 1972, an AMF Experimental Safety Vehicle crash test was conducted. Although the air bags deployed in this test demonstration, three of the four test dummies failed to meet the injury criteria of FMVSS 208. In April 1972, air bags in a Fairchild Experimental Safety Vehicle test failed to inflate. A month later, in a crash test at Wayne State University's automobile safety center, air bags again failed to activate. The test dummy broke the steering wheel and hit the windshield. Toms, while testifying before the House Subcommittee on Finance in June 1972, referred to two of the above tests. He stated that the failures occurred under unusual circumstances that were not representative of those that production air bags would meet. Toms stated,

These two failures were both in situations where the mechanisms were assembled for one-time use by people who have not had a great deal of experience in their assembly. These errors do happen.

The NHTSA responded to the criticisms by strongly defending the safety potential of air bags. Robert Carter of the NHTSA's Vehicle Structures Division

was quoted as saying, "I haven't seen anything [about the air bag] I would consider a significant problem." Another agency official was quoted in the Wall Street Journal (March 12, 1971) as saying,

We have here a system that has a tremendous potential for saving lives, but it also has a small potential for causing injury and even a few fatalities. We're just going to have to live with it.

Finally, NHTSA Administrator Toms, analyzing automakers' criticisms, declared, "When you push an industry this large, there is a lot of ill feeling and bitterness, but we accept this."

Chrysler Corporation vs. Department of Transportation

Responding on April 29 to the NHTSA's final action on FMVSS 208 (Notice 9, March 10, 1971), Chrysler challenged the regulation in the U.S. Court of Appeals for the Sixth Circuit. The court consolidated similar complaints by Ford, Jeep, American Motors, and the Automobile Importers of America (AIA) during the summer. In September 1971, Chrysler filed its initial brief. Subsequent modification of FMVSS 208 on October 1, 1971 (Notice 12) caused Chrysler to submit a supplemental brief. In January 1972 the DOT (NHTSA) responded to the petitioners with its own brief, and, finally, on December 5, 1972, the court ruled on the case.

Chrysler's Argument

Chrysler argued that the NHTSA had violated both the Safety Act of 1966 and the Administrative Procedures Act (APA). The former defines a motor vehicle safety regulation as "a minimum standard for motor vehicle performance" (15 U.S.C. 1391(2)). It further requires that the agency consider whether the regulation is "reasonable, practicable and appropriate for the particular type of motor vehicle. . ." (15 U.S.C. 1392(f)(3)), and that the regulation "shall be practicable, shall meet the need for motor vehicle safety, and shall be stated in objective terms" (15 U.S.C. 1392(a)). The APA required that the court "set aside agency action, finding, and conclusions found to be . . . arbitrary, capricious, and abuse of discretion . . . (or) unsupported by substantial evidence" (5 U.S.C. 706,2(A)(e)). On each of these grounds, Chrysler claimed FMVSS 208 or the NHTSA were deficient.

Chrysler argued as follows:

1. a. The requirement of objectivity was not met because the testing procedures prescribed by the NHTSA were vague and the anthropomorphic testing dummy was not an adequate measuring tool. In addition, since the NHTSA had warned in the order accompanying FMVSS 208 that the testing requirements were likely to change in the future, compliance testing was virtually impossible.
- b. FMVSS 208 was not practicable because adequate technology to implement air bags did not yet exist. The NHTSA's own testing was

inconclusive, and "substantial research, development, and test work resulting in technological breakthrough [would] be required to produce satisfactory complying devices." Chrysler denied that the NHTSA had authority to act as a "catalyst" for industrial change.

- c. The passive protection requirement was not in the interests of safety for several reasons: it was not within the agency's provenance to protect the public from its own unreasonable refusal to use seatbelts, already proven effective; seatbelt warning and interlock systems were actively precluded by the regulation; and doubt existed as to the safety of the air bag system — air bags might actually prove hazardous, impairing hearing or posing dangers to out-of-position passengers or children. Chrysler cited reports of NHTSA tests that "had to be terminated because air bag actuation could, by itself, cause injury to heavily protected individuals."
 - d. FMVSS 208 was not "reasonable" or "appropriate" because adequate testing had not proved air bags better than seatbelts. "In addition, MVSS 208 is unreasonable because it will have a severe adverse effect on the economy and competition in the automobile industry," possibly eliminating some types of vehicles, such as compacts or subcompacts.
 - e. FMVSS 208 was a design rather than a performance standard "because it prohibits the use of nonpassive alternatives providing more reasonable and proven solutions to the problem of nonuse of seatbelts and because it contains an inherent bias favoring air bags." Finally, the regulations were not minimum standards because "the requirements of MVSS 208 are beyond the capability of existing technology and preclude the use of a number of systems capable of meeting the nonuse problem."
2. The APA requires that promulgation of a new standard not be "arbitrary, capricious, and abuse of discretion." Alleging that FMVSS 208 was neither practicable, objective, or reasonable, Chrysler argued that the NHTSA's action in mandating the standard was clearly irrational and inconsistent. Since, according to Chrysler, adequate research had not been done, the NHTSA's rulemaking "was an inconsistent, premature and speculative action [and] cannot be allowed to stand."
 3. Chrysler argued two further points: that the NHTSA had denied interested parties opportunity to comment on the regulation, and even withheld relevant material from the public docket; and, that all its previous arguments indicated FMVSS 208 to be "unsupported by substantial evidence."

NHTSA's Argument

The NHTSA described the Chrysler argument as an attempt "to characterize the agency proceedings under review as haphazard and ill-advised." The "Statement of Facts" portion of its brief, therefore, included a number of sections

explaining the history of FMVSS 208. Topics covered were relevant statutes, the ANPRM of July 1969, the NPRM of May 1970, the NATO Passive Restraint Conference, the June 1970 public meeting, the rule of November 1970, the rule of March 1971, the rule of October 1971, and judicial proceedings.

The NHTSA's defense against Chrysler's allegations was as follows:

1. The scope of review of the court was limited. It could not consider the substance of FMVSS 208, but could rule only on whether the NHTSA complied with the appropriate procedural requirements and whether the agency's ruling reflected a rational consideration of the relevant matters.
2. The NHTSA did have Congressional authority to issue standards requiring improvements in existing technology. In fact, "Congress conferred upon the Agency the power to issue Standards requiring future levels of motor vehicle performance." The NHTSA agreed that it could not require the impossible. Nonetheless, its rulemaking authority "could be based on much more than the technology already developed by the industry."
3. The NHTSA had not acted arbitrarily or irrationally in its decision to compel installation of passive restraint systems. The agency "rationally determined relatively early in the proceeding that the requisite technology had been developed, and later gave manufacturers adequate leadtime to install" passive restraints. Moreover, passive restraint systems were an effective safety measure which would save lives; sensors had been developed so that accidental deployment was unlikely; the noise factor was negligible; and danger to out-of-position passengers was minimal. Seatbelts, while effective when used, were, in fact, seldom used. Air bags were automatic and thus offered greater protection than seatbelts.
4. The NHTSA dismissed the petitioner's remaining arguments as being without merit. The agency asserted that: FMVSS 208 was stated in objective terms; the testing dummy was a suitable device, though not perfect; the NHTSA had assured the automobile industry that charges of noncompliance would not be based on the dummy's admitted limitations; and the test procedure for rollover was not vague. Furthermore, FMVSS 208 was a performance standard, since passive restraints other than air bags were permitted; it was a minimum standard; the agency had considered economic matters; and FMVSS 208 would not eliminate sports cars, convertibles, or other automobile lines.
5. The NHTSA defended its rulemaking procedures. Its standard could not be declared invalid simply because it had been amended, particularly since "the overwhelming majority of rulemaking developments of which petitioners now complain are attributable to comments submitted by the manufacturers and other interested parties." The agency denied that it improperly compiled its record, and declared that it had given, as required, a general statement of the basis for its ruling.

Court Ruling

In its ruling the court generally agreed with the NHTSA, in particular concurring that: (1) the agency was empowered to issue standards requiring improvements in existing technology; and (2) that its actions were rational rather than arbitrary and haphazard. However, the court agreed with the petitioners that the test procedures and test dummy specified in FMVSS 208 did not meet the required criterion of objectivity. The standard was remanded to the agency with instructions.

The court ruled on specific arguments as follows:

1. The court agreed that its review powers were limited and that it could not "substitute [its] judgment as to discretionary decisions made by the Agency." Nonetheless, in order to determine whether a rule was practicable or objective, or its promulgation arbitrary or capricious, the court ruled that it must examine in depth all the evidence on which the agency had based its decision.
2. The court disagreed with Chrysler, ruling that the agency had been given authority to require reasonable technological development in the interests of safety. The court also dismissed Chrysler's claim that FMVSS 208 was not practicable because air bag technology had not yet been developed enough for mass production. Citing GM, Eaton, and Irvin Industries reports, the court held that the technology did exist and noted furthermore that "many of the development problems with which the petitioners have concerned themselves in their briefs [such as noise, sensor reliability, danger to out-of-position occupants, and effectiveness in certain nonfrontal impact modes] had been eliminated."
3. The court ruled that the effectiveness of air bags, as opposed to seatbelts, as well as the effectiveness of passive as opposed to active restraints, was a judgment the NHTSA was empowered to make, and which it made based on substantial evidence.
4. The court agreed with Chrysler in its assertion that the test procedures and test dummies specified in FMVSS 208 were not objective "and must be clearly delineated by the Agency." A manufacturer could not be expected to develop a restraint system without a reliable testing device which would produce repeatable test results. Also, the court agreed (primarily with an AIA brief, but noted also by Chrysler) that FMVSS 208 might eliminate convertibles and sport cars. The court held that the NHTSA had to give special consideration in its regulation to such vehicles.
5. The court agreed with the NHTSA that its proceedings showed flexibility and response to public and industrial comment on its proposed regulation. The court also dismissed Chrysler's claim that the NHTSA withheld information from its docket, stating that this information for the most part was not of great importance, and did not prejudice the petitioner's case.

The final ruling, therefore, remanded the standard to the agency with instructions: (1) to deal in the regulation with sports cars and convertibles; and (2) to write further specifications for test devices in objective terms. The effective date of implementation was delayed until "a reasonable time after such test specifications were issued." The court opinion was written by Circuit Judge John W. Peck. Judge William Miller, however, also wrote an opinion, concurring in part and dissenting in part. Agreeing basically with Judge Peck's opinion, Judge Miller went further, to totally dismiss the petitioner's case. He argued that the requirement of objectivity applied to the regulation itself, not to testing procedures or devices. Furthermore, he did not agree with the position that "under the legislation the government has the sole burden of developing and perfecting methods of compliance testing and that the NHTSA cannot require the automobile industry to develop or refine compliance testing devices." He would have dismissed the petitioner's complaint and ordered the regulation upheld.

II. FMVSS 208: 1973-1976

Rulemaking, 1973 - 1976

The SAE J963 dummy previously specified for use in FMVSS 208 had been invalidated as a sufficiently objective testing device by the court in the Chrysler case. Subsequently, the NHTSA promulgated new dummy specifications for testing passive restraint systems which manufacturers could choose to offer as an option between August 15, 1973, and August 15, 1975.

On April 2, 1973, a test dummy requirement and an accompanying amendment to FMVSS 208 were proposed in Notice 1 (Docket 73-8; 38 FR 8455). Both design and performance criteria for dummy specification were presented. The proposed dummy design was the GM Hybrid II dummy, a model considered by the NHTSA to represent the "most satisfactory design" commercially available. Performance specifications were provided to serve as calibration checks and to help insure repeatable results. Notice 2, published on August 1, 1973 (38 FR 20449), adopted the NPRM that specified the GM Hybrid II dummy to measure the performance of vehicles in crashes. The NHTSA said,

The immediate purpose of this rulemaking is to reconstitute those portions of the standard that will enable manufacturers to build passive restraint vehicles during the period when they are optional. . . . One fact weighing in favor of the decision [to use the Hybrid II] is that GM has used this dummy to measure conformity of its vehicles to the passive protection requirements of Standard 208, in preparation for the announced introduction of up to 100,000 air bag equipped vehicles during the 1974 model year.

The dummy was not specified for use with any protection systems after August 15, 1975, nor with active belt systems under the third option. Continued

dummy test programs were encouraged "in the hope that any problems that [might] arise could be identified and resolved before the dummy specifications for later periods [were] issued."

There were a number of minor modifications to FMVSS 208 proposed between 1973 and early 1974. Among these was a change in the effective date of the standard from August 15, 1973, to September 1, 1973 (Docket 69-7-Notice 28; 38 FR 19049). September 1, 1973, became the effective date in Notice 29, published on August 14, 1973 (38 FR 21930).

The NHTSA issued an ANPRM on November 9, 1973 (Docket 73-26-Notice 1; 38 FR 31017) that considered amending safety standards as they applied to police vehicles. Comments were invited and a public meeting was held on December 10, 1973. After considering all information submitted, the NHTSA decided that "rulemaking action to exempt all police vehicles from the requirements of Standard 208 was inadvisable." Notice 2 (39 FR 25240), published on July 9, 1974, terminated the rulemaking proceedings concerning police vehicles.

On January 29, 1974, the NHTSA granted Sebring-Vanguard, Inc.'s petition for a 1-year temporary exemption from FMVSS 208 for its electrically-powered CitiCar (Docket 73-9-Notice 2; 39 FR 3710). Although the vehicle was equipped with lapbelts and padded dashboard, the manufacturer was uncertain if the frame of the car, whose top speed was 28 mph, could withstand the required crash forces for upper torso restraints. In addition to the minimal impact on motor vehicle safety due to the nature of the exemption, the NHTSA determined that

... by allowing production and sale of an electric vehicle, the exemption would facilitate the development and field evaluation of a low-emission vehicle... [and] would allow the public the choice of transportation independent of available supplies of gasoline.

On April 25, 1974 (Notice 2; 39 FR 14593), the NHTSA specified emergency and special release requirements for passive belts and set procedures for determining whether a belt system could qualify as a passive restraint system in accordance with an interpretation of the standard published on May 4, 1971. The notice answered the question of what constituted "no action by vehicle occupants" in a vehicle equipped with passive belts:

Entry and exit action "that requires no action other than would be required if the protective system were not present in the vehicle" means that a person is not hampered in his normal movements by the presence of the belt system. . . . The essence of a passive restraint is that it provides at least the minimum level of protection without relying on occupant action to deploy the restraint. . . . It would not be required that the belt position itself for maximum comfort of the occupant, if it met the safety requirements.

On March 19, 1974, an ANPPM (Docket 74-15-Notice 1; 39 FR 10273) advised the public that "the NHTSA [was] considering upgrading the requirements of Standard 208 to provide protection for occupants in crashes at higher speeds." Under consideration was an amendment, effective September 1, 1980, to require either 45- or 50-mph crash protection. The NHTSA stated that the higher level of protection would "work a manifold increase in the lifesaving capability of occupant crash protection systems."

Also on March 19, 1974, an NPRM (Docket 74-14-Notice 1; 39 FR 10271) proposed new occupant crash protection requirements beginning September 1, 1976. The new requirements were to

. . . extend the current options for passenger cars one year to August 31, 1976. After that date, passenger cars would be required to provide passive protection in frontal and angular (in the front designated seating positions) and lateral crash modes, by the same criteria as in the present "first option." If they could meet the rollover test by passive means, no front seatbelt systems would be required, although they would of course be available as options, with anchorages provided. If they could not meet the passive rollover test, they would be required to have lapbelts at all seating positions, meet the crash test criteria additionally with the belts fastened, and have sequential warning systems for the belts at all frontal positions. Vehicles other than passenger cars would essentially be phased 2 years behind passenger cars as at present.

The proposed extension of the three options was not issued as a final rule during 1974. Moreover, the third option, an ignition interlock system, was prohibited by Congressional action in October 1974 (see following section). An amendment to FMVSS 208 immediately deleted the interlock option from the standard, replacing it with the former third option, a lap and shoulder belt combination. The termination date for the interim period and the beginning of required passive protection was August 15, 1975 (Docket 74-39-Notice 1; 39 FR 38380). A notice of April 10, 1975 (Docket 74-14-Notice 3; 40 FR 16217), proposed to extend the three-option interim period until August 31, 1976. Notice 4 (40 FR 33977), published on August 13, 1975, adopted this amendment, effective immediately.

Two modifications to the standard were proposed in 1975. In response to petitions from Chrysler and Jeep, the NHTSA proposed an amendment to permit, until January 1, 1976, the installation of current seatbelt assemblies in trucks and multipurpose passenger vehicles with a gross vehicle weight rating of 10,000 lbs or less (Docket 75-14-Notice 1; June 3, 1975; 40 FR 23897). Notice 2, published on July 9, 1975 (40 FR 28805), adopted this proposal.

The other modification, proposed on December 31, 1975 (Docket 75-33-Notice 1; 40 FR 60075), would have permitted certain U.S. Postal Service vehicles to "continue to meet present requirements for occupant protection after new requirements for most light trucks and MPV [multipurpose passenger vehicles] on January 1, 1976."

After consideration of comments submitted in response to Notice 1, the NHTSA concluded that the "new requirements for lap and shoulder belt assemblies at the driver's position in this limited category of vehicle [was] not justified because their interference with the many entries and exits from the vehicle [might] discourage usage." Notice 2, published on March 18, 1976 (41 FR 11312), amended FMVSS 208 as proposed.

The Interlock Controversy

On February 24, 1972, the NHTSA had amended FMVSS 208 to include an interlock system as the third option for the interim period August 15, 1973, to August 15, 1975 (Docket 69-7-Notice 16; 37 FR 3911). The NHTSA found the interlock requirements were "the subject of diverse comments." In addition to questioning seating requirements and injury criteria, several comments indicated "doubts as to the system's reliability and expressed concern about its possible interference with vehicle operation."

A court decision in February 1973 (No. 72-1179, U.S. Court of Appeals, 6th Circuit) invalidated those portions of the seatbelt interlock option which relied on the test dummy for measurement of injury criteria. As a result, modification of the option became necessary. Proposals made in an NPRM of April 20, 1973 (Notice 26; 38 FR 9830) were adopted in Notice 27, published June 20, 1973 (38 FR 16072). This amendment deleted the requirement that seatbelts at front outboard seating positions meet injury criteria, and that interlock systems be installed at front center positions. In addition, the conditions under which the interlock was to work were defined. The vehicle engine would not start unless the belt at each front outboard position was fastened when either

- (a) a person of at least the weight of a 5th-percentile adult female was seated at the driver's seating position
- (b) a person of at least the weight of a 50th-percentile adult male was seated at the driver's position and a person of at least the weight of a 50th percentile 6-year old child was seated at the front right seating position.

The engine would restart without interference from a belt interlock after the engine had stopped:

- o If the ignition had not been turned off,
- o Within a period of not more than 3 minutes after the ignition had been turned off,
- o If the driver had not left his seated position,
- o Within a period of not more than 3 minutes after the driver had left his seated position.

Finally, a provision was added to the standard to permit "bounce switches." If the belt system had been operated after the occupant was seated, the engine-starting system would remain operable if:

- o The occupant had left his or her seated position for a period of not more than 3 minutes without unbuckling or retracting the belt,
- o The occupant had left his seated position without opening either front door and without unbuckling or retracting the belt.

After appearing in automobiles in the fall of 1973, the ignition interlock was severely criticized by the motoring public. The Insurance Institute for Highway Safety (IIHS) quoted an "in-house" NHTSA bulletin as stating,

Over 98% of the persons writing to NHTSA about the ignition interlock system oppose it. . . . Major reasons cited are that the interlock is an infringement on individual rights, that it is cumbersome and inconvenient and that it will be an added burden to the car's electric system.

Because both the interlock system and the buzzer-light system could be circumvented, it could not be assumed that car occupants were necessarily using belts. A study by the IIHS to document the extent of seatbelt use in vehicles with interlock and buzzer-light systems found that in 1974 MY vehicles with interlocks, 48 percent of the front seat occupants used lap and shoulder belts, and 11 percent used lapbelts only, for a total of 59 percent usage. ^{25/}

Controversy over the interlock soon involved Congress in the issue. On August 12, 1974, during debate on the interlock requirement in the House of Representatives, Representative John E. Moss gave the following explanation of the origins of the regulation:

The interlock was brought about over the objections of the Department of Transportation as a result of the visit of the presidents of two of the major manufacturers of automobiles with the President of the United States, and at a subsequent meeting attended by Mr. John Ehrlichman, Mr. Robert Flanagan, and another White House aide, the order was issued to the Department of Transportation to go along with the interlock rather than the alternative system which the Department of Transportation had under study as an intermediate device.

Congress responded to public criticism of the interlock in October by passing Public Law 93-492 (October 27, 1974). The law amended the Safety Act of 1966 and stated that no motor vehicle safety standard could require, or permit a

^{25/} L.S. Robertson, "Safety Belt Use in Automobiles With Starter Interlock and Buzzer-Light Reminder Systems," American Journal of Public Health, Vol. 65, December 1975.

manufacturer to comply with, a standard by means of a safety belt interlock system or a continuous buzzer. The term "safety belt interlock" was defined as any system designed to prevent starting or operation of a motor vehicle if one or more occupants of such vehicle were not using safety belts. The term "continuous buzzer" meant a buzzer other than a buzzer which operated only during the 8-second period after the ignition was turned to the "start" or "on" position. The Secretary of Transportation was required to amend FMVSS 208 to conform with this law no later than 60 days after its enactment and to put the amended standard into effect no later than 120 days after the law's enactment.

In addition, the law required that the House Interstate and Foreign Commerce Committee and the Senate Commerce Committee be notified in writing of any proposed occupant restraint standard, and that it be transmitted to both Houses of Congress, where a concurrent resolution of disapproval could be passed within the next 60 days during which Congress was in session. In any case, the standard could not be effective until the end of that 60-day period.

Because it was illegal for manufacturers, distributors, dealers, or motor vehicle repair businesses to disconnect any safety device installed in an automobile in compliance with motor vehicle safety standards, the law amended this section so that it did not apply to the disconnection of any safety belt interlock system or any continuous buzzer warning.

The ignition interlock was eliminated from FMVSS 208 in Notice 1, on October 31, 1974 (Docket 74-39; 39 FR 38380). Public Law 93-492 had specified that lap and shoulder belt assemblies be installed until further rulemaking was undertaken. Accordingly, this notice amended the third option to specify seatbelts without interlocks, effective immediately.

New rulemaking was proposed at the same time. Notice 2 (Docket 74-39; 39 FR 38391) proposed an amendment that would "establish a new warning system for seatbelt assemblies to replace the present warning system." The NHTSA's proposed modifications were:

- o A continuous or intermittent audible warning operating 4 to 8 seconds after the ignition was turned on if the driver's belt was not in use;
- o A continuous or flashing reminder light operating 4 to 8 seconds after the ignition was turned on. The light was to operate independently of belt use, so that the reminder would remain effective even if the belts were disabled to silence the audible warning.

The proposal was adopted on December 6, 1974 (Notice 3; 39 FR 42692), and established a "new warning system for seatbelt assemblies to replace the present warning system after February 24, 1975." Until that date, the new system could be used as an alternative to the current by effective requirement. An additional requirement for passive belt systems was also included. A visual/auditory warning for passive belts would activate for at least 1 minute whenever the latch mechanism was not fastened and the ignition was on, or whenever the vehicle was running with the transmission in any forward gear position.

Congressional Hearings, 1973-1976

1973 Senate Commerce Committee Hearing

A hearing on air bag development and technology was held on August 1, 1973, before the Senate Committee on Commerce. Witnesses at the hearing included representatives from the NHTSA, Allstate Insurance, Ford, Chrysler, and GM. James Wilson, Acting Administrator of the NHTSA, opened the hearing by describing developments in FMVSS 208 since the court ruling in the Chrysler case in December 1972.

A representative of Allstate testified on air bag noise. He commented that Allstate's test driver "said he never heard the air bag deploy over the sound of the crash. He was also wearing glasses. They were neither broken nor knocked out of place on his face by the air bag deployment."

Senator Theodore Stevens expressed concern about air bag performance in sub-zero temperatures. Robert Carter, NHTSA's Associate Administrator for Motor Vehicle Programs, replied that although test cars had been placed in cold areas, the NHTSA had not done as much work in that area as it should have.

Representatives from the automobile industry were generally cautious in their comments on passive restraints and agreed that more testing experience was needed. A GM vice-president remarked, "The air cushion can be offered in these cars only after they have been tested with dummies meeting the new specifications." A Ford vice-president stated, "The purpose of our early work on air bags was to explore a concept we thought might supplement, not replace, belt restraint systems."

Senate and House Appropriations Committee Hearings

The effectiveness of an air bag system and the state of its development for mass installations were of major concern at the July 16, 1973, Senate Appropriations Subcommittee hearing. In his statement, James E. Wilson, Acting Administrator of the NHTSA, said that "it is the opinion of the NHTSA, as well as General Motors and numerous crash research groups, that air cushion systems meeting the initial requirements of a 30 mile an hour barrier crash are ready for mass installations in motor vehicles. No significant development problems remain."

Wilson stated that a passive restraint system in which "safety belts should not be required" would include air cushions for head-on collisions, heavily padded, strengthened doors for side collisions, and laminated safety glass to prevent ejection in rollovers. Wilson remarked that "lap belts may offer some additional protection in some kinds of crashes, but could also degrade passive system performance in others." Even so, "those who personally desire to buy and use safety belts for additional protection can easily do so," he said.

Dr. James B. Gregory, Administrator of the NHTSA, and Carter testified before the House and Senate Appropriations Subcommittees during the spring of

1974 concerning the relative merits and costs of the air bag and passive restraint systems as opposed to the current seatbelt system. Carter stated that the standard, in effect, says that you can "drive your car into a wall at 30 miles an hour, either head on or minus 30 degrees, and [you] don't get hurt. It says the car can be hit on the side by a 4,000 pound moving barrier at 20 miles an hour and [you don't] get hurt. It says the car can be rolled at 30 miles an hour and no part of your body will be outside of the vehicle."

At the House Subcommittee hearing, Dr. Gregory said, "Were the standard ultimately to become effective what you would see in most cars would be an air-cushion system with lap belts." However, in testifying before the Senate, Carter stated that, provided the standard's criteria were met, "we know of no necessity or no real reason for the need of the belt." The advantages of air bags over seatbelts, he continued, included their superiority in frontal impacts where most of the accident fatalities occur. Air bags would have a 100-percent usage rate, while the mandatory usage rate on seatbelts, as experienced in Australia, was about 75 percent, he said.

In regard to air bag testing, Carter acknowledged that "the dummy did not provide repeatable results." He also remarked that out-of-position tests had been made with "adults leaning with their faces looking down. We cannot do this with children but have conducted baboon tests which lead us to think there are no problems." Later in the hearing it was noted that it would be safest to have children in the 4- to 10-year-old age range ride in the rear seat. Air bag research expenditures from 1967-1974 totaled \$5,691,000 or 89.9 percent of all the funds allocated for passive restraint research. Future costs of the passive restraint field test program were estimated as follows: 1976 — \$1,000,000; 1977 — \$750,000; 1978 — \$400,000; 1979 — \$200,000; and 1980 — \$200,000.

At the 1975 hearings, Dr. Gregory outlined the NHTSA's accomplishments in occupant packaging through 1975. Areas of development included the evaluation of child protection systems, the feasibility of crash sensors in conjunction with passive restraints, reduced air bag deployment time, and driver restraints in subcompact cars.

Carter remarked that when notices were sent out concerning proposed 45- to 50-mph crash protection, "the responses we got from the industry were, in my judgment, almost ridiculous in terms of cost penalties and weight penalties." Carter felt that "the industry attitude in general today has been one of resistance rather than cooperation."

GM had intended to sell 100,000 cars equipped with air bags; however, less than 10,000 had been produced as of April 1, 1975. Dr. Gregory stated that "in all likelihood, it will be impossible to arrive at any statistically significant conclusions as to the effectiveness of air bags based on the accident experience from these meager sales." He expected "less than 200 towaway or greater accidents by the end of September 1975 when the data collection activities of this phase of our restraint systems study project ends."

Dr. Gregory felt that "in the area of the passive standard 208, we have indeed done an indepth study." A 20-percent or \$200,000 increase was requested in occupant packaging for additional small car research, child protection, demonstration testing, and compliance test development. Through 1975, a total of \$5,100,000 had been spent on air bag research, with an additional \$700,000 on a passive belt program and \$2,083,000 on active belt systems. The proposed 1976 air bag research costs were \$800,000.

In a 1976 House Appropriations Subcommittee hearing, Dr. Gregory reviewed the agency's accomplishments and defined the policies of the 1975-76 year. When questioned on the number of highway fatalities, he stated, "The next big reduction in highway fatalities and serious injuries is going to come about through better use of occupant restraints."

Representative John McFall, Subcommittee Chairman, questioned Dr. Gregory on an article entitled "The Effects of Automobile Regulation." The author, Sam Petizman, "found that cars with safety devices have forty percent more accidents than cars without them." Dr. Gregory, however, disagreed saying, "Our analysis shows that there is probably no difference in the accident involvement rates." Dr. Gregory was also asked to summarize the May 1975 public hearing (see next section) on occupant crash protection. Consumer views at this hearing had been directly oppocsed to those of the automobile industry; consumers felt that the passive restraints were needed and long overdue, while the automobile industry stated that passive restraints would be too costly to the consumer, and that consumers would not buy the passive restraints if given an option.

The cost of air bag research through 1976 was \$6,311,000. The proposed funds allotted for occupant packaging for 1977 were \$1 million of which \$700,000 would be spent on air bags.

May 1975 Public Hearing

On May 19-21, 1975, the NHTSA conducted a public hearing on the subject of passive protection for occupants of motor vehicles. The NHTSA indicated that the purpose of the meeting was to obtain the latest and best information available from the industry prior to completing the rulemaking to amend FMVSS 208 to require passive restraints. In his opening remarks, Dr. Gregory declared:

The issue of passive protection has been debated now for more than six years. Large quantities of data have been developed in support of passive restraint systems. At the same time, the proposed systems have had their detractors who have provided detailed rationales. It is high time, after all that has been said and done to resolve the issue.

Following Dr. Gregory's presentation, comments were made by members of Congress who had an interest in the oversight of the DOT. Senator Thomas Eagleton strongly questioned the technological state-of-the-art of air bags, their reliability, their economical feasibility, and their net effectiveness. He suggested that not enough attention had been paid to seatbelts and the possibilities of

increasing their use. He added,

While we are studying the air bag, however, we should recall that our goal is not so much to develop an air bag, but rather to save lives and reduce injuries. Air bags, fully proved, may or may not be the best means of so doing. There must continue to be parallel discussion of alternatives to air bags that might meet roughly the same objectives.

Senator Warren Magnuson strongly supported the passive restraint requirement and was opposed to any action on the part of the DOT to promote mandatory seatbelt use.

The subject of the relative effectiveness of seatbelts and air bags arose in various presentations during the meeting. Dr. William Haddon (former Director of the NHTSA) of the IHS referred to a public awareness campaign to promote an increase in the use of seatbelts that appeared to have no impact on the usage rate. Dr. Haddon declared, "Like it or not, the idea that belt use levels can be substantially increased by persuasion is unsupported by the record and contrary to the scientific evidence. 'Persuasion' is a dead issue."

A representative of the American Safety Belt Council strongly favored the seatbelt and supported his argument with statistics reporting the success of mandatory seatbelt laws, their costs, and demonstrated effectiveness.

The question of estimating the effectiveness of passive restraints was also discussed by many of the participants at the meeting. The NHTSA was criticized for changing its position. For example, Economics and Science Planning (E&SP) said,

The use figures that NHTSA originally employed in its computations of the benefits of restraint systems were 60 percent for lapbelts in either bag or belt restraint systems, and 50 percent for the shoulder harness. Since the starter interlock and continuous buzzer have now been precluded by legislation, NHTSA has revised its figures to 20 percent for lap belts and 15 percent for shoulder belts, figures that appear overly pessimistic.

The NHTSA was also criticized for using effectiveness figures which, in E&SP's estimation, were not supported by the real-world experience: "The effectiveness of the lap-shoulder harness in mitigating fatalities still appears to be seriously underestimated by NHTSA. NHTSA's estimate is in direct disagreement with large-scale real-life experience."

Ford recommended a government-sponsored demonstration program:

We would like to see all proposals for passive restraints set aside until the administration can conduct an adequately large field test of air bags in service. It has been suggested the test should be government financed and supervised. We believe the

program should examine the acceptability not only of the system itself, but also the consumer's willingness to pay for it.

Chrysler took a strong position against the implementation of the standard on the basis that the state-of-the-art had not advanced sufficiently to provide the expected protection and that air bags were not truly passive:

Air bag restraint systems as presently developed are not passive. A lap belt must be worn to provide adequate protection in many types of accidents. A belt is required for maximum protection in frontal accidents and provides the only effective restraint in lateral impacts and rollovers. Therefore, for belt users, the air bag becomes a \$300 shoulder belt in frontal collisions only.

Chrysler also discussed the necessity of a field test program:

We continue to believe that air bags, or any other new restraint system, should be thoroughly field tested to assure its reliability, cost effectiveness and public acceptance before they are mandated for all cars. Such an arbitrary action taken without adequate research would be ill-advised and not in the public interest.

Allied Chemical, a company which had been active in restraint system development, proposed a gradual phase-in of advanced systems after adequate demonstration of their effectiveness. In conclusion, the company expressed frustration at not knowing what to expect from the DOT:

We now find ourselves and the rest of the auto industry, not knowing when the DOT will issue a new Standard 208, nor what it will specify, nor when it might become effective, and whether the Congress will reject whatever standard is issued. The longer these questions remain unanswered, the more difficult it will become for the industry to respond quickly.

A representative of the Council on Wage and Price Stability presented the results of an evaluation of the NHTSA's occupant protection program. The Council's principal concern, he stated, was that "the consumer get a cost-effective restraint system; one which when put into actual use will give people their money's worth in terms of improved protection and which the public will be willing to accept."

The Council's report recommended that the NHTSA consider four options if it determined that passive restraints were necessary. These options included: (1) implementing FMVSS 208 as is, at the earliest possible dates; (2) conducting a government sponsored demonstration program; (3) conducting expanded lab tests; and (4) doing nothing. The Council report recommended the second option. Such a demonstration program "would involve many fewer cars (and thus much less aggregate expense) and would put the costs of the experiment on the federal government rather than on a small consumer."

In his concluding remarks at the meeting, Dr. Gregory acknowledged that cost was a major factor in considering passive restraints. However, he emphasized that safety was the overriding factor: "While the cost and economic impact of a safety standard is an important factor in considering the reasonableness of that standard, the legislative history of the Act and NHTSA responsibilities put safety considerations first."

Technology and Testing, 1973 to 1976

Development and testing of passive restraint systems continued between 1973 and 1976. Two belt-type systems, the passive belt and inflatable belt, both showed particular promise as alternatives to the air bag. Passive belts had been developed by numerous manufacturers and suppliers, including Volvo, Hamill, American Safety Equipment, and Takata Kojyo Co. One successful system had been created by Volkswagen, and consisted of a diagonal torso belt attached to the vehicle door and to a retractor between the seats. When the door was opened, the belt was pulled away from the seat so the occupant could enter. Closing the door automatically pulled the shoulder belt across the chest of the occupant. A retractor spool took up slack in the webbing and locked automatically at a vehicle acceleration of 0.45 g. The system also included a foam-filled knee bolster and an emergency release to prevent an occupant from being trapped after a crash. Volkswagen began installing their passive belt as an option on 1975 MY and later Rabbit model vehicles. 26/

Ford Motor Company of Germany also developed a passive belt system. Based on the same general principles as the Volkswagen belt, the Ford system featured a "self-applying" 3-point harness. In addition, an electronic sensor identified an impact and activated a system which caused the belt webbing to wind up about 6 inches, tightly restraining the occupant 18 milliseconds after impact.

An inflatable belt system called the "Inflataband" was developed by Allied Chemical. A similar system for subcompact cars was developed by researchers at Minicars, Inc., under contract to the NHTSA. Though not fully passive, the inflatable belt distributed loads more evenly than standard belts, while retaining positive belt features such as rollover and lateral crash protection. Calspan Corporation conducted tests using 3-point inflatable belts and cadavers and found that the air belt system offered greater protection than the standard 3-point harness. 27/

26/ V. Seiffert, K. Oehm, and H. Paitula, "Description of Volkswagen Restraint Automatic (VWRA) used in a Fleet Test Program," Society of Automotive Engineers, February 1974.

27/ J.M. Burkes, J.R. Cromack, T.H. Glenn, "Human Volunteer Testing of the Inflatable Belt Restraint," Proceedings, 19th Conference of the American Association for Automotive Medicine, October 1975; M. Fitzpatrick, T. Egbert, "Inflatable Belt Development for Subcompact Car Passengers," Minicars, Inc., September 1975 (DOT Report HS-801720). See also, M. Walsh, "Sled Tests of Three-Point Systems Including Air Belt Restraints," Calspan Corp., 1976 (DOT Report HS-801939).

Between 1973 and 1976 the NHTSA sponsored a variety of projects to test and develop air bag systems. Olin Corporation, for example, conducted a program entitled, "Development of Improved Inflation Techniques for Restraint Systems." The objective of the project was "to provide frontal crash protection up to 50 mph for front seat occupants without undue hazards to out-of-position occupants during deployment." 28/ Olin concluded, from 27 sled tests conducted between July 1973 and June 1974, that the system could be effective in meeting FMVSS 208 injury criteria.

Other contractors conducted testing to develop air bag systems effective at speeds above 30 mph, particularly for small cars. A Calspan report of a project completed in January 1976, for example, described sled tests at higher speeds using adult and child dummies. The air bag system appeared "capable of providing protection from fatality or serious injury to adult size occupants in a small car environment up through the 40-50 mph crash speed regime." An interim report for April 1975 had cautioned, however, that variability in test results due to dummy type and uncertain differences between dummy and real human response prevented conclusive results from the testing. Furthermore, both interim and final reports concluded that the air bag system offered a safer environment for small children at the higher speeds tested only if they were seated in a normal position. The final report concluded,

If a child is up against the system which may well be the case during a panic breaking situation, the resultant loading on the child is extremely sensitive to the specific geometry of the bolster, vehicle interior, and the method of bag folding. 29/

A later Calspan final report described the first year of a 24-month developmental testing program for an aspirator air bag system. It concluded that the system "satisfied injury criteria for a full range of adult dummy sizes through the 45 mph crash speed regime." It was also optimistic concerning out-of-position children, but indicated the need for further testing. The air bag system tested seemed to protect a child better than no system at all, and the report added, "... It appears that the system can be made innocuous to the out-of-position child. It is recommended that the development and evaluation of this concept should be continued in the second phase of the program, [and] that the evaluation should include a broader range of vehicle accident conditions. . . ." 30/

28/ D.W. Marlow, J.T. Johnson, "Development of Improved Inflation Techniques for Restraint Systems, Final Reports," Olin Corp., 1975 (DOT Report HS-801226).

29/ David Romeo, "Development of an Air Bag-Crushable Dash-Knee Bar Passive Restraint System for Small Cars. Final Report," January 1976; and "Advanced Passive Restraint System for Subcompact Size Vehicle Front Seat Passengers," Progress Report No. 10, April 27, 1975, Calspan Corp. (DOT Contract HS-4-00972).

30/ David Romeo, "Development of a Front Passenger Aspirator Air Bag System for Small Cars, Final Report," Calspan Corp., 1976 (DOT Contract HS-5-01254, Report HS-802039).

Other testing attempted to resolve specific questions concerning possible hazards associated with air bags, in particular noise and the effect of inadvertent deployment. A University of Michigan study using monkeys found no permanent hearing damage associated with air bag actuation; a GM study using human volunteers also found noise not to be a significant problem. 31/

The effect of inadvertent deployment on a driver's control of a vehicle had often been raised as an unknown hazard of air bag systems. A "startle" test using 51 volunteers found that an unexpected air bag deployment was "not likely to cause such a severe startle reaction as to produce an increase in the incidence of accidents. . . ." Though drivers' hands were knocked off the steering wheel, none lost control of the vehicle, nor was an inability to see found to present a problem. 32/

Finally, a series of projects were contracted which evaluated the human surrogates—dummies and cadavers—used to test the effectiveness of inflatable restraints. Projects at Wayne State University and Southwest Research Institute, for example, evaluated injuries to cadavers restrained by seatbelts. Other testing was done to compare anthropomorphic dummies and cadavers in accident situations. One 1976 Calspan study found "reasonable correlation" between a near 50th-percentile cadaver and two types of dummies in nearly identical crashes.33/

Another Calspan study, however, reported specific cases where "dummy results were not capable of locating problem areas of restraint systems which were evident from cadaver results." The report urged that development of cadaver measurement and test techniques be continued. 34/

The problem of relating testing procedures to real-world performance was brought up in another light in a paper on the NHTSA's National Crash Severity Study (NCSS). This study pointed out a number of collision factors for which data needed to be collected. These included (quoting from the report):

Variation in g-forces for a fixed [change in velocity]. In particular, offset frontal collisions, which are especially common on the highway, have lower g-forces than fixed barrier crashes of the same [change in velocity]

31/ H.J. Richter, R.L. Stalnaker, J.E. Pugh, "Otologic Hazards of Air Bag Restraint System, "Proceedings, 18th Stapp Car Crash Conference," SAE Report No. 741185, December 1974; R. Hickling, "An Investigation of the Noise and Overpressure Generated by the Safety Air Cushion," General Motors Corp., 1974.

32/ H. Haskell Ziperman, George R. Smith, "Startle Reaction to Air-Bag Restraints," Journal of the American Medical Association, Vol. 233, August 4, 1975.

33/ Michael J. Walsh, "Sled Test Comparisons Between Three Types of Human Surrogates, Final Report," Calspan Corp., 1976 (DOT Report HS-802003).

34/ Michael J. Walsh, David J. Romeo, "Results of Cadaver and Anthropomorphic Dummy Tests in Identical Crash Situations," Calspan Corp., 1976, (DOT Report 020-137).

The role of vertical forces in nonrollover collisions. . . .
Vertical forces are insignificant in flat barrier tests but quite common on the highway. . . .

The role of vehicle rotation yawing in nonrollover impact. . . .
The vehicle interior spins while the occupant moves straight ahead. . . . Rotation is likely to occur in offset collisions, which are common on the highway. . . .

Occupant preimpact actions. Such actions as bracing or change in posture may effect both contact points and tolerance to impact. 35/

Real-World Performance of Air Bags

One of the major controversies surrounding FMVSS 208 had been the question of whether testing of inflatable restraint systems adequately reflected real-world performance. The first vehicles equipped with air cushions, therefore, were closely watched. Field testing began in 1972 when Ford placed in service 831 equipped with air bags. These vehicles entered government and private vehicle fleets so that their accident experience could be closely monitored. Shortly thereafter, GM created a similar fleet of approximately 1,000 air bag-equipped, full-size Chevrolets. In January 1974, GM began offering the air bag as an option on full-size Buick, Cadillac, and Oldsmobile cars. In addition, Volvo placed 75 air bag-equipped 1975 sedans into three private fleets beginning in January 1975. Table 1 details the total of air bag-equipped vehicles manufactured as of April 1976.

Table 1: Manufacture of Air Bag-Equipped Cars as of April 30, 1976 1/

Ford and Eaton test fleet: 1972 Mercury Monterey	831
General Motors test fleet: 1973 Chevrolet Impala	1,006
Volvo test fleet: 1975 Volvo	75
General Motors: Buick, Cadillac, and Oldsmobile	
1974 MY	5,518
1975 MY	4,006
1976 MY	427
Total	11,857

1/ From: "Summary of Field Experience Involving Air-Bag Equipped Cars," Office of Statistics and Analysis, NHTSA, September 1, 1976.

This test fleet was considerably smaller than that which had been hoped for. The gasoline crisis of 1973-1974, as well as other factors, caused GM to drastically

35/ Charles J. Kahane, Russell A. Smith, K.J. Tharpe Corp., "The National Crash Severity Study," Proceedings, the 6th International Congress of Experimental Safety Vehicles, 1976, p. 500-501.

curtail the planned production of 150,000 vehicles equipped with its Air Cushion Restraint System (ACRS). The relatively small number of air bag-equipped cars almost eliminated the possibility for useful statistical analysis. Nonetheless, investigation of accidents involving air bag-equipped vehicles began immediately.

In November 1973, an automotive safety engineer for GM described the first year of operation of GM's 1,000-vehicle ACRS fleet. In over 19 million cumulative miles driven, there had been 9 accidents in which the air bag had deployed and 230 nondeployment accidents. In addition, one inadvertent actuation had occurred. In one of the nine accidents, a collision near Schererville, Indiana, on May 16, 1973, a 7-week-old infant was killed. GM refused to draw conclusions from the limited data, but believed the initial field results were encouraging, and suggested that the ACRS appeared to be functioning as it should. 36/

A 1975 NHTSA report presented accident data on the ACRS-equipped, 1974 and 1975 MY Buicks, Cadillacs, and Oldsmobiles sold by GM to the public (approximately 5,200 vehicles as of October 31, 1974.) 37/ Another report by one of the NHTSA's multidisciplinary accident investigation teams described investigations of 26 accidents occurring between 1974 and 1976. The study concluded that

more information is needed for policy makers to make appropriate changes to FMVSS 208. Continued research into the injury-reducing potential of ACRS and belt-equipped vehicles is needed to properly assess these restraints. 38/

By April 1976, 90 accidents involving air bag deployments had occurred. These accidents involved four fatalities. The first, the infant death noted above, had occurred in May 1973 in Indiana. The second occurred on July 11, 1974, in George West, Texas, when a 1972 Mercury crashed into a tractor-trailer. The third occurred in Memphis, Tennessee, on February 29, 1976, when a 1974 Oldsmobile crashed into a pole. The fourth occurred on March 11, 1976, when a 1974 Oldsmobile crashed head on into another vehicle in Lake Villa, Illinois. 39/

These fatalities were used as a basis for one of the first analyses of air bag effectiveness based on real-world data. Charles Kahane, of NHTSA's Office of Statistics and Analysis, wrote an in-house paper which compared predicted

36/ George R. Smith, "Field Testing 1000 Air Cushion Equipped Automobiles," Proceedings, the 17th Conference of the American Association for Automotive Medicine, November 14-17, 1973, pp. 443-464.

37/ Russell A. Smith, Charles J. Kahane, "1974 Accident Experience With Air Cushion Restraint Systems," NHTSA, February 1975 (Contract Report No. HS-801565).

38/ J. Robert Cromack, et al., "Multidisciplinary Accident Investigations: Special Study of Active and Passive Restraint Systems in 1973-1976 Model Year Vehicles," Vol. 2, March 22, 1976, p. 17 (DOT Contract No. HS-024-1-11S).

39/ A fifth fatality in an air bag-equipped vehicle occurred on July 1, 1978, in Gadsden, Alabama.

fatalities based on NHTSA estimates of air bag effectiveness to the available field experience. Kahane found that "the actual number of deaths is at best four times as high as the expected number," and added, "the high incidence of fatalities may be suggestive that the air bag is totally ineffective in fatality reduction." Using the NHTSA's own estimates of air bag performance, he concluded that

the field data, although limited in quantity and scope, thus raise a striking contrast between actual and predicted experience. The statistical evidence is sufficient to reject the hypothesis that air bags are 55 percent effective in reducing fatalities in all frontal impacts. 40/

Benefit/Cost Studies

The NHTSA prepared its first major benefit/cost analysis of FMVSS 208 in August 1974. In particular, the study analyzed proposed changes to the standard which had been issued in an NPRM of March 19, 1974. The study concluded that if the total passenger car population was equipped with an interlock-belt system, between 5,320 and 9,270 lives could be saved, and 300,000 to over 400,000 injuries prevented. If the proposed air cushion-lapbelt system was instituted, between 13,300 and 18,700 lives would be saved, and between 730,000 and over a million injuries prevented (see Table 2).

Table 2: Societal Benefits of FMVSS 208

1. Current Interlock-Belt System:	<u>Lives saved</u>	<u>Injuries prevented</u>
Pessimistic estimate	5,320	300,000
Most likely estimate	7,000	340,000
Optimistic estimate	9,270	420,000
2. Proposed Air Cushion-Lapbelt System:		
Pessimistic estimate	13,300	730,000
Most likely estimate	15,600	1,000,000
Optimistic estimate	18,700	1,170,000

In addition, the study used three different techniques for economic analysis, and found benefit/cost ratios to range from 2.9 to 5.2 for interlock-belt systems, and from 3.6 to 6.0 for an air cushion-lap belt system. The report concluded that

40/ Charles Kahane, "Statistical Analysis of Air Bag Deaths," NHTSA, April 9, 1976, pp 1-3. Kahane's study was not released by the NHTSA until 1978. It was disclosed when the Pacific Legal Foundation specifically requested it in the course of a suit filed against the DOT.

the proposed rulemaking, represented by the air cushion-lapbelt system, is clearly superior to the interlock-belt system in the reduction of fatalities and injuries. Furthermore, the air cushion-lapbelt system is fully justified even from an economic point of view since its benefit/cost ratio and its incremental benefit/cost ratio (incremental benefits/incremental costs) are substantially in excess of 1.0. 41/

An amendment to this report became necessary later in 1974. Not only had the first report generated considerable public comment, but Congressional action had banned the seatbelt interlock system. This required changes in factors used in the benefit and cost estimates. Nonetheless, the amended study concluded,

Progressing from lap shoulder belt systems to air cushion lap belt systems would ultimately save an additional 8,900 lives and 492,000 injuries annually and the ratio of increased benefits to increased costs would be 4.2. Thus the air cushion lapbelt system would be clearly superior, primarily on the basis of safety, but also based on economic justification. 42/

In August 1975, the John Z. DeLorean Corporation completed a study for Allstate. The study, "Automotive Occupant Protective Safety Air Cushion Expenditure/Benefit Study," was designed to "evaluate the total benefits and expenditures associated with various restraint systems . . . from 1975 to 1985." Four restraint systems were evaluated—"the lapbelt, the present three-point lap torso system and the air cushion restraint system (ACRS); with and without the use of lapbelts." The study concluded that air cushion restraint systems for front seats were beneficial, that delayed implementation would "result in 37,600 needless losses of life. . . [over the 10-year period 1975 to 1985]," and that mandatory seatbelt use laws were impractical and would require years to implement. The study also concluded that the actual additional cost to the consumer for an air cushion/lapbelt system would be \$111.50 for a six-passenger car, and \$90 for a four-passenger car.

III. FMVSS 208: 1976-Present

The Coleman Decision, 1976

William T. Coleman assumed office as the Secretary of Transportation in March 1975. Shortly thereafter, he requested recommendations from his staff for options concerning FMVSS 208. In February 1976, the Assistant Secretary for Systems Development and Technology, Hamilton Herman, responded, indicating strong opposition to the implementation of FMVSS 208 with a passive restraint requirement:

41/ "Analysis of Effects of Proposed Changes to Passenger Car Requirements of MVSS 208, NHTSA," August 1974.

42/ "Amendment to Analysis of Effects of Proposed Changes to Passenger Car Requirements of MVSS 208," NHTSA, December 1974.

1. The supporting data base does not appear adequate for inclusion of the air bag/lapbelt system as an MVSS 208 option at this time.
2. Improvement in comfort and convenience is key to increased usage [of existing belt systems] and, in turn, to achieving acceptance of mandatory usage.
3. Phased implementation is a useful tool for controlling regulatory impact and risk, and obtaining public acceptance of standards. 43/

Herman continued,

I believe we do not have adequate field test data on the performance of air bag/lapbelt systems nor do we have adequate engineering data at extremes of temperature, humidity, vibration, and other environmental conditions, including the sequential and cycling tests normally associated with durability, reliability, and lifetime measurements for equipment of this type. We also need more barrier test data in side and angular frontal collisions, and over the full range of operating speeds.

On June 14, 1976, Secretary Coleman published an NPRM (41 FR 24070) in which he announced to the public his desire to reopen discussion on occupant restraints. He stated that

questions of effectiveness, cost and suspected hazards, as well as the philosophical problems of restricting individuals' freedom of choice with regard to how much they pay for safety protection, have been raised by opponents of the air bag. It is in the context of this controversy that I must make a decision as to the future of passive restraints.

A public meeting was scheduled for August 3, 1976, and the NHTSA's docket was to be held open for written comments until September 17, 1976. Coleman promised he would issue a written decision by January 1, 1977.

In the NPRM, Secretary Coleman indicated a broad range of issues which he considered relevant to the formulation of a final rule. These included the appropriate role of the Federal government, benefits and costs of alternative occupant restraint systems, and public acceptance. He listed specific questions for which he felt answers were needed:

1. Are the air cushion and passive belt systems technologically feasible?
2. Are the cash estimates presented of the costs and benefits of various occupant crash protection systems reasonably accurate?

(C) 43/ DOT Memorandum dated February 26, 1976; Subject: FMVSS 208, Occupant Restraint Systems.

3. What would be the effect of a shift to smaller cars?
4. What effect will the decision on FMVSS 208 have on automobile insurance rates?
5. What effect will the decision on FMVSS 208 have on sales employment in the automotive industry?
6. To what extent should benefits, costs, and benefit/cost ratios be weighed in arriving at a decision?
7. Are there sufficient data available at present to assess adequately the effectiveness of the various occupant restraint systems?

Other issues mentioned in the NPRM concerned potential safety hazards associated with air bags, including:

1. Hearing damage due to acoustic shock from air bag inflation.
2. Eye damage as a result of eyeglasses breakage and other trauma due to air bag deployment.
3. Toxicity of chemicals used for air bag deployment.
4. Unreliability of air bag actuation: (a) inadvertent actuation, (b) failure to actuate when needed.
5. Air bag-inflicted injury to improperly positioned occupants.
6. Improper disposal of air bag actuators.

Finally, Secretary Coleman emphasized his belief that any final occupant restraint standard must meet with the public's approval:

Public acceptance is necessarily of great consequence to the success of Federal efforts to increase automotive safety. While temporary gains can be achieved with unpopular and restrictive safety regulations, experience with the ignition interlock requirement and motorcycle helmet laws shows that safety regulations which significantly curtail personal freedom are frequently overturned.

Coleman concluded the NPRM by proposing five alternative courses of action regarding FMVSS 208:

- o Alternative I: Continuation of the existing requirement, extending the current three-option rule for some period in the future.
- o Alternative II: Mandatory seatbelt usage laws initiated by the States, while continuing the present rule.
- o Alternative III: A Federally sponsored field test of passive restraints, while continuing the present rule.
- o Alternative IV: Mandatory passive restraints, with a proposed effective date of August 31, 1979.

- o **Alternative V:** A mandatory passive restraint option, requiring auto makers to provide the option of passive restraints in some or all of their models beginning September 1, 1979.

In an appendix to the NPRM, Secretary Coleman included a benefit/cost analysis of occupant crash protection systems. It included safety effectiveness estimates for several types of restraint systems. For example, lapbelts were estimated to reduce serious, critical, and fatal injury by 40 percent, a lap and shoulder belt combination by 60 percent, an air cushion by 40 percent, and an air cushion and lapbelt combination by 60 percent. Tables also indicated annual benefits of restraint systems, measured both in terms of dollars and fatalities saved. Requiring front seat protection by an air cushion and lap belt was estimated to save 11,200 lives and a societal cost of \$4.23 billion. (See Table 3.)

Table 3. — Annual benefits of occupant crash protection systems

System	Fatalities saved	Injuries avoided or reduced	Societal benefits (billions of dollars)
15% lap and shoulder, 5% lap only	3,000	159,300	1.18
35% lap and shoulder, 5% lap only	6,300	342,600	2.48
70% lap and shoulder	11,500	641,400	4.55
Air cushion and lap belt:			
Full front	11,200	171,800	4.23
Driver only	9,200	168,600	3.44
Passive belt and knee bolster	8,200	373,300	3.62
Mandatory option:			
5% air cushion	3,400	182,700	1.36
10% air cushion	4,100	182,100	1.60
25% air cushion	5,400	180,300	2.06

Finally, a benefit/cost ratio table compared various types and degrees of protection. Benefit/cost ratios for 35 percent lap-shoulder belt use and 5 percent lapbelt only use ranged from 3.5 to 5.0; for 70 percent lap-shoulder belt use from 6.5 to 9.1; for air cushion and lapbelt, full-front protection, from 1.2 to 4.2.

Comment on the Secretary's June 14 notice began immediately. At the public hearing held on August 3, 1976, representatives from citizens' groups, automobile manufacturers, insurance companies, producers of restraint systems, and safety experts responded to Coleman's proposals. In addition, over 7,000 letters from individual citizens were collected in the public docket. A review of this correspondence by the NHTSA found that of 7,169 letters, 3,624 opposed mandatory air bags, while 2,021 supported them.

The Safety Board also commented on the Coleman proposals. In a letter to the Secretary on December 3, 1976, Safety Board Chairman Webster B. Todd, Jr. wrote:

In view of the positive impact derived from mandatory passive restraints, we recommend Alternative IV [mandatory passive restraints]. Further, we recommend inclusion of the total front seat in the protective zone effective concurrent with that for the driver.

In part, the Safety Board's recommendation resulted from a belief that the public would not react adversely to mandatory passive restraints, but that "public acceptance [would] follow a decision." The letter added that the Safety Board recognized the controversial nature of the passive restraint issue, and acknowledged that the position expressed in the letter was "not unanimously shared by the Board."

While comment on the June 14, 1976 NPRM was being made during the summer, rulemaking continued on FMVSS 208. Notice 5 (Docket 74-14; 41 FR 29715), published on July 19, 1976, proposed an amendment that would extend the three options for occupant crash protection until August 31, 1977. The NHTSA proposed several modifications to the passive protection options, associated injury criteria, and test procedures. New dummy positioning procedures were proposed, and the leg injury criterion was raised to 2,250 lbs of force.

On August 30, 1976, Notice 6 (Docket 74-14; 41 FR 36494) adopted the proposal to continue the three options until August 31, 1977. Submitted comment supported Notice 5, but vehicle manufacturers requested that "the options be extended indefinitely instead of being limited to a one year extension." However, the NHTSA replied that

because a one year extension is consistent with the [rulemaking] process that had been established and because a longer extension was not proposed for comment, the NHTSA declines to extend the existing requirement as recommended by the manufacturers.

On December 8, 1976, Secretary Coleman issued his decision on FMVSS 208. Rejecting all five of his proposed alternatives, he decided instead "to call upon the automobile manufacturers to join the Federal government in conducting a large-scale demonstration program to exhibit the effectiveness of passive restraints." He stated that he would request at least two manufacturers to enter into agreements with the government to produce a total of 500,000 air bag-equipped cars. Half would contain full-front air bag protection, half would contain driver-side-only air bags. Various model sizes would be included in the demonstration fleet, and would be available beginning September 1, 1978, for a price not to exceed \$100 for the full front system.

The Secretary offered three major reasons for his decision. First, he stated, "the goal of motor vehicle safety would not be served by a mandate of passive restraints which is ultimately rejected by the public." Second, requiring passive protection would mean replacing the lap-and-shoulder seatbelt system that is effective when used, with passive restraint systems which have a yet unknown effectiveness and reliability. Third, a demonstration program "could create sufficient consumer demand for passive restraints that manufacturers would voluntarily offer them as an option . . . or as standard equipment."

In the course of his decision, Coleman explained specifically his reasons for rejecting each of the five alternatives proposed in June. He also offered additional arguments which had led to his decision, concluding,

Some will argue that a demonstration has the disadvantage of postponing the widespread installation of passive restraints in automobiles for a period of years. They will contend that the value of this program is not worth the delay. . . . I respectfully disagree. . . . I believe this approach offers the best hope that passive restraints will ultimately be accepted by the American people. . . .

Appended to Secretary Coleman's December decision was a second benefit/cost analysis. In general, it paralleled the analysis which accompanied the June 14, 1976 NPRM. However, several modifications were made. For example, the effectiveness of the combination air cushion and lapbelt in reducing serious, critical, and fatal injury changed from 60 to 66 percent. The table detailing benefits of restraint systems was altered slightly. In the June analysis a full-front air cushion and lapbelt system was estimated to save 11,200 lives, and to prevent or reduce 171,800 injuries. In the December analysis a full-front air cushion alone was projected to save 12,100 lives and to prevent 104,000 moderate-to-critical injuries. The estimates for the cost of air bag protection per automobile were also revised. The June study stated the NHTSA's estimate of the cost of full-front air cushion protection at \$190. In the December analysis this was modified to \$97. Finally, the benefit/cost ratios of various protection systems were slightly modified.

On January 18, 1977, the Secretary announced that agreements had been reached with GM and Ford to manufacture a demonstration fleet of air bag-equipped cars. However, the automobile manufacturers committed themselves to

only 60,000 vehicles rather than the 500,000 that the Secretary had announced in December. In a separate agreement, Volkswagen agreed to produce 125,000 passive belt-equipped automobiles between model years 1975 and 1980.

The Adams Decision, 1977

The new Secretary of Transportation, Brock Adams, stated in his confirmation hearings on January 7, 1977, that he intended to review Coleman's decision. On March 21, 1977, he issued an NPRM (Docket 74-14-Notice 8; 42 FR 15935) thereby terminating the agreements with automobile manufacturers for a demonstration fleet. Adams expressed concern over the former Secretary's ruling, in particular, disagreeing with Coleman's fear of adverse public reaction to a mandatory passive restraint regulation:

I believe a decision based upon anticipated consumer resistance needs reconsideration because I cannot agree that consumers would respond to passive restraints in the same fashion as the ignition-interlock. The ignition-interlock was a "forced-action" system that... represented a constant interference with the occupants behavior and understandably became a source of irritation. In direct contrast, the passive restraint requires no action to be effective.

In addition, Secretary Adams expressed his sense of the immediate need for passive protection in light of the projected downsizing of American automobiles:

I am also concerned that the negotiated contracts represent a 5 to 8 year delay in any decision to install passive restraints in passenger cars... [when] it appears that the safety need for occupant protection may increase in the relatively near future.

Based on these concerns, Secretary Adams announced a public hearing to be held on April 27, 1977, and offered three alternative courses of action for consideration. His proposals were as follows:

The first approach proposed would be to continue the existing requirements of the standard, reflecting a determination based on submitted comments that the estimates of savings in fatalities and injuries are significantly overstated, or that they are outweighed by negative impacts attributable to a passive restraint standard or belt use law.

The second approach would be to mandate passive restraints along the lines proposed by the Department in June 1976.... This proposal would require the installation of passive restraints at all front designated seating positions of passenger cars manufactured on or after September 1, 1980. Passive protection would be required in front and front-angular impacts into a barrier at speeds up to 30 miles per hour. A lapbelt would be required at each designated seating position for lateral and rollover protection, unless the manufacturer chooses to provide lateral and rollover protection by passive means.

To preserve some flexibility, it is proposed in the alternative that passive protection be implemented first at either the driver's position or that of the right front passenger. In this case "full front" protection would follow at a later date. Specific comments on the nature and timing of these alternatives is requested.

The third approach would be to push the level of seatbelt use upward to the range of 80-85 percent through the States enactment of mandatory seatbelt use laws.

Secretary Adams' proposal invoked the provisions of the Safety Act of 1966 as amended by Public Law 93-492 on October 27, 1974. This amendment directed that a public hearing be held upon the proposal of any occupant restraint system other than seatbelts, and also directed that Congress be notified of any such action. Therefore, Secretary Adams' proposal was transmitted to Congress on March 21, 1977.

At the public hearing on April 27 and 28, 1977, Secretary Adams heard testimony from 78 representatives of industry, interest groups, and concerned citizens. In general, positions established at previous meetings and in docket comments were repeated. Most of the testimony concerned the air cushion method of passive restraint or dealt with the practicality of obtaining results from mandatory safety belt usage laws enacted by the States.

The Safety Board commented on Secretary Adams' NPRM in a letter of May 13, 1977. The Safety Board urged the DOT to adopt the second alternative (mandatory passive restraints) proposed in the NPRM. However, it also urged consideration of passive belts, an alternative which had received little notice at the public hearing. The Safety Board noted Volkswagen's development of the passive belt, as well as its advantages in terms of cost and lead time. The letter concluded, recommending "that increased study be given to passive belt restraints as an additional method, apparently able to meet the purposes of the NPRM."

Secretary Adams issued a final ruling on June 30, 1977 (Docket 74-14-Notice 10; FR 34289). The decision required

provision of "passive" restraint protection in passenger cars with wheelbase greater than 114 inches manufactured on and after September 1, 1981, in passenger cars with wheelbases greater than 100 inches on and after September 1, 1982, and in all passenger cars manufactured on or after September 1, 1983.

Active belts were to be required along with passive protection, and automobile manufacturers were given two options for continuing these restraints. Passive protection could be provided for frontal crash modes only, with lapbelts included at all seating positions for protection in lateral and rollover crashes; or full passive protection for front seat occupants in frontal, side, and rollover crashes could be provided, with lapbelts continuing to be required for all rear seating positions.

In an explanation accompanying the decision, Secretary Adams discussed the basis for his ruling. He reiterated his rationale for reassessing Coleman's program, adding,

The Department reconsidered the December 1976 decision because public acceptance or rejection of passive restraints is not one of the statutory criteria which the Department is charged by law to apply in establishing standards.

In addition, he declared, "... The demonstration program introduced a minimum 3-year delay in implementation of mandatory passive restraints."

The explanation went on to discuss specific issues relating to FMVSS 208:

1. Need for rulemaking action: The Secretary emphasized that the "trend toward smaller cars to improve economy and emissions performance contains a potential for increased hazard to the vehicles' occupants." Mandatory belt use laws had been suggested as one solution, but Adams believed the prospects for passage of such laws to be poor.

2. Effectiveness of passive restraints: Secretary Adams pointed to effectiveness estimates (those from former Secretary Coleman's December decision) showing that air cushion and lapbelts could reduce fatalities by 66 percent, as contrasted to a 60-percent effectiveness rating (in reducing fatalities) for lap and shoulder belts, 50 percent for passive belts and knee bolster, and 40 percent for either air cushion or lapbelt alone.

In the discussion of passive restraint effectiveness, Secretary Adams dismissed two effectiveness studies for methodological weaknesses: a GM matching case analysis which concluded that the air cushion-lap belt combination would save only 3,000 lives per year; and an IIHS study which indicated an air cushion fatality reduction effectiveness of 66 percent.^{44/} Comparing expected accidents and injuries with those observed in the air bag-equipped fleet, however, the Secretary offered two additional NHTSA estimates of air bag effectiveness in frontal crashes —58 percent and 52 percent.

Secretary Adams, referring to the criticism that the NHTSA should not have issued a standard without significant real-world data, stated, "statistical 'proof' is certainly desirable in decisionmaking, but it is often not available to resolve public policy decisions." He concluded that in spite of uncertainties in safety effectiveness estimates, "the results of the field experience are encouraging."

^{44/} The GM study is succinctly described in the Passive Restraint Hearings before the Subcommittee on Consumer Protection and Finance of the House Committee on Interstate and Foreign Commerce, September 9 and 12, 1977 (Serial No. 95-89), pp. 89-94. The IIHS study, by Mohan, et al., was entitled "Air Bags and Lap/Shoulder Belts—A Comparison of their Effectiveness in Real World, Frontal Crashes," September 1976.

3. Cost of passive restraints: A chart compared various estimates of air bag costs. For full front protection, the DOT estimated \$141 (original purchase cost plus operating costs), compared to a GM estimate (of June 1977) of \$246, and a Ford estimate (October 1976) of \$422. Adams also discussed insurance premium savings, declaring that Nationwide Mutual Insurance Companies estimated savings at \$32.50 per car per year.

4. Side effects of air bag installation: The Secretary concluded that "injuries caused by design deployment, though worthy of careful monitoring with a view to design improvements by manufacturers, do not provide a serious argument against a passive restraint requirement."

Regarding out-of-position occupants, he stated that "much development work has been devoted to this problem in the past," and added that "with one exception [the death of an infant lying laterally on a front seat] there have been no cases where out-of-position occupants have been found to be seriously injured in crashes in which air bags have deployed."

Secretary Adams estimated that inadvertent actuation occurred annually in only one out of every 15,000 vehicles. He regarded this fear of inadvertent deployment as not "a weighty argument against a passive restraint requirement," but did acknowledge that "inadvertent actuation could cause loss of control by some segments (aged, inexperienced, distracted) of the driving population and it must be viewed as a small but real cost of air bag protection." The Secretary declared that current air cushion designs had advanced "to the point where ear damage is no longer a significant possibility." Furthermore, he added, real-world experience as well as testing had shown eyeglasses, pipes, and cigarettes not to be a hazard during air bag deployment.

5. Small cars: Secretary Adams declared, "The evidence from studies conducted by the Department with air bags in small cars, is that there are no insuperable difficulties in meeting the 30 mph crash requirements of Standard 208 in cars as small as 2,000 pounds gross vehicle weight rating with existing air bag designs."

6. Leadtime and production readiness: Because of the necessary redesigning and production problems associated with installing air cushion systems, the Secretary decided to phase-in passive restraint requirements over several years. The purpose of the phase in was to "establish quality systems in production to obtain experience with these systems in the hands of a more limited segment of the public and to obtain feedback on the performance and reliability of the systems." In addition, Adams determined that "a lead time of four full years should precede the requirement for the production of the first passive-equipped passenger cars." This leadtime, he argued, represented "a continuation to its logical conclusion of the early voluntary production of passive restraints represented by the December 1976 decision." Though the contracts arranged by Secretary Coleman had been voided, Adams stated that he anticipated "that the manufacturers which were parties to the earlier demonstration program agreements [would] continue their current preparations for voluntary production of passive restraints." This would allow an "early, gradual, and voluntary introduction of passive restraints to the public. . . ."

7. Other considerations: A Final Environmental Impact Statement was released along with the publication of the final rule on July 5, 1977. Two significant issues related to air bag systems were discussed: sodium azide, the chemical used to generate gas for air bags; and the fuel consumption consequences of the weight added to a vehicle by air bag systems. Regarding sodium azide, the Secretary stated that the "inaccessibility and strength of the sealed canisters" would allow the toxic chemical to be safely used in vehicles. The chemical left in junked cars could easily be disposed of by deploying the air bag with an electric charge. As for fuel consumption, the DOT estimated an annual increase of 0.71 percent, or about 521 million gallons, based on the increased vehicle weight. Adams stated that "while this increase is not insignificant, the Department believes that it is fully justified by the prospective societal benefits of passive restraints."

Congressional Action on the Adams Decision

On the same day that Secretary Adams issued his final rule, June 30, 1977, Representative E. G. (Bud) Shuster and Senator Robert Griffin introduced concurrent resolutions to overturn the DOT action. This action was taken in accordance with the Safety Act of 1966 as amended in 1974. In addition, Representative John Murphy had proposed legislation on January 4, 1977 (H.R. 1019) which would require passive protection. As a result of these legislative proposals, 5 days of hearings were held in September 1977 before the Subcommittee on Consumer Protection and Finance of the House Committee on Interstate and Foreign Commerce and the Subcommittee for Consumers of the Senate Committee on Commerce, Science, and Transportation.

A major issue at both hearings was testing experience and effectiveness estimates related to air bags. A Ford representative stated that "all effectiveness studies of air bags, of necessity, are based on subjective judgment because there are insufficient real world data from which to draw fully objective conclusions." GM had tried to rectify this by comparing accident data from air bag-equipped vehicles with similar accident data from non-air bag-equipped vehicles using what was called a "matching case methodology." Data from each air bag deployment accident were entered into a computer, and each accident was matched with a non-air bag accident based on the characteristics of impact direction, area of vehicle damage, extent of vehicle crush, object contacted, and estimated equivalent barrier speed. Based on the results of these data, GM estimated that "air cushion effectiveness in deployment accidents over this injury range [Abbreviated Injury Scale of two or greater ^{45/}] would be six percent." The Ford representative commented that "it is clear that the [DOT] chose not only to reject the conclusions of this study that did not fit a decision to mandate bags, but also to flee any exploration of accident data from real world collisions that might prove unsuitable to its case."

^{45/} The Abbreviated Injury Scale (AIS) is a medically developed set of criteria for identifying the severity of injuries. The scale ranges from 1, minor injury, to 6, fatal injury.

The NHTSA defended its estimates of passive restraint effectiveness. Howard Dugoff, Deputy Administrator of the NHTSA, stated before the House Subcommittee:

We have made an analysis which is as comprehensive and complete as any the NHTSA has ever made to analyze the prospective effectiveness of a regulation. . . .

At the same hearing the newly appointed NHTSA Administrator, Joan Claybrook, testified that the effectiveness estimates had been based primarily on experimental testing and that "the real world data, in our view, has really substantiated and endorsed the results of the estimates."

Questions concerning sodium azide, a chemical used to inflate air bags, were also raised at the hearings. Although the chemical had been chosen because its end reaction produced harmless nitrogen gas, it was reported that sodium azide itself was "a well known deadly poison." The NHTSA was quoted as stating that "abandoned vehicles with active inflatable air bags are extreme hazards to youths, vandals, and persons seeking replacement parts for their vehicles." A representative of Talley Industries added, "There has been a hint that terrorists will be after the sodium azide propellant in the inflators for terrorist activity." However, he maintained that "the inflators are sturdy pieces of equipment. . . designed so that they cannot be punctured from the outside to get at the propellant."

Liability, in cases of accidental deployment or nondeployment in an accident, was raised as another important issue. In some States, it was noted, "a seller is liable for the design and function of a product as well as the manufacturer." A representative of the American Insurance Association added that normal practice "is to name in a product liability suit anybody in any way associated with the distribution or manufacture of the vehicle." A representative of Nationwide Insurance stated that product liability was not a major problem. He declared that "the insurers of the suppliers of air bags have been into this product liability question and they have assured the suppliers that they will continue to insure them at no additional cost."

Another cost-related problem which was raised concerned repairs to air bag-equipped cars. A representative of the International Mobile Air Conditioning Association related the case of a car brought in for service on the heater. Because it was an air bag-equipped car, the dealer would not do the job and referred it to another dealer. The labor costs were tripled "because of the complexity of the wiring system going in through the dash and the other area of the car that had to be touched."

The president of the American Safety Belt Council described the opinions of people he had talked to in his efforts to increase safety belt use. He stated that the majority of people were concerned about and opposed to the passive restraint order and air bags. They were concerned not only with the issues of cost, replacement, possible accidental deployment, and freedom of choice, but with "the Government's paternalistic attitude in telling you what you ought to have in your car."

Congressman John Dingell questioned the safety of the air bag. He commented that "it's been reported that air bags have been accidentally deployed from [citizen band radio] flux and from radar speed traps. . . ." Others, however, defended the safety effectiveness of air bags. A representative of Allstate pointed out that "in many crashes air bags have offered complete protection against flying glass and metal." A Nationwide Insurance representative added that "there is no question about their ability to save thousands of lives each year."

After the hearings, both House and Senate Committees produced reports supporting the Adams decision and recommending that the Shuster-Griffin concurrent resolutions not be passed. The House Subcommittee concluded that "FMVSS 208 . . . is strongly supported by the evidence. . . ." In a detailed analysis of the various passive restraint effectiveness estimates, the report declared:

Perhaps the most significant finding on this particular question is, indeed, that the differences among the various studies are less remarkable than their similarities. . . . While particular studies diverge widely in their estimates of the absolute effectiveness of given restraint systems . . . the greater relative effectiveness of passive restraints is clearly borne out.

A minority view prepared by 2 of the Subcommittees' 10 members questioned Secretary Adams decision. A variety of factors including the issues of air bag effectiveness and the safety of sodium azide led them to conclude that it was "abundantly clear that much more data and experience are needed before the Federal Government mandates the use of air bags."

The report of the Senate Committee similarly supported Secretary Adams' ruling. It stated:

The committee is convinced that the Department of Transportation passive restraint rule would provide major increased protection for front-seat automobile occupants from fatal or seriously disabling automobile accidents.

A minority view favored former Secretary Coleman's program and opposed "a Government mandate which, on the basis of insufficient information, would force air bags or other passive restraints on all car buyers."

On October 12, 1977, Congress rejected the legislation to overturn the passive restraint rule, thereby affirming Secretary Adams' decision. On December 5, 1977, the Secretary issued a second final rule (Docket 74-14-Notice 12; 42 FR 61466) in which he rejected petitions for reconsideration filed by automobile manufacturers during the fall.

Additional Rulemaking, 1976-1979

While the events associated with Secretary Coleman's and Secretary Adams' decisionmaking were taking place, other rulemaking activity related to FMVSS 208 continued. An ANPRM published on December 16, 1976 (Docket 74-14-Notice 7; 41

FR 54961) solicited discussion on ways to improve seatbelt rate of use and effectiveness. Improved comfort and convenience of seatbelts was a major concern in the ANPRM. The proposal specifically asked:

Could improved consumer acceptance and hence increased rates of seatbelt use be achieved through the establishment of specifications for ease of donning and stowing and for the comfort of seatbelt systems?

The ANPRM generated over 100 responses, including a letter of April 14, 1977, from the Safety Board. The Board supported the intent of the proposal and suggested that the NHTSA consider a "round or oval cross-section belt filled with foam," to prevent shoulder belt irritation of the neck. The proposed rulemaking has not advanced beyond the ANPRM stage.

Much of the additional rulemaking activity between 1976 and 1979 concerned petitions for temporary exemptions from the requirements of FMVSS 208. The following are examples of the types of petitions received by the NHTSA.

On February 16, 1978, the NHTSA published a notice of receipt of a petition filed by Vintage Reproductions, Inc. The company requested temporary exemption from virtually all motor vehicle safety standards, including FMVSS 208 (Docket EX 78-1-Notice 1; 43 FR 6865). ^{46/} Vintage argued that "most safety standards were not reasonable, practicable, or appropriate for the configuration of 1900-style (Horseless Carriage) vehicles." No more than 432 autos were expected to be manufactured before terminating production. In support of its petition the company argued that its replica vehicles would not present a significant hazard to traffic safety. The company would also suffer a loss of over \$150,000 in the year following a denial.

Marathon Electric Vehicles, Inc., petitioned for a 2-year exemption from compliance with several safety standards, including Standard 208, on the basis that an exemption would "facilitate the development and field evaluation of a low emission motor vehicle" and that an exemption would not "unduly degrade" the safety of the vehicle. A notice of receipt of this petition was published on June 26, 1978 (Docket EX 78-4-Notice 1; 43 FR 27630).

Other petitions requested exemption from the requirements of the Safety Act of 1966 detailing procedures to be followed when noncompliance with a safety standard was discovered. On May 1, 1978, for example, the NHTSA published a notice of receipt of a petition filed by GM to be exempted from the requirements of the Safety Act of 1966 for an apparent noncompliance with Standard 208 (IP 78-2-Notice 1; 43 FR 18618). The basis of the petition was that the noncompliance was inconsequential as it related to motor vehicle safety. The standard required that the seatbelt warning system display the words "Fasten Seat Belts" or "Fasten Belts." The petition stated that in 196,118 Pontiacs the system displayed only the

^{46/} Notices of receipt of a petition for a temporary exemption were published in accordance with 49 CFR 555.7 and did not represent any agency decision or other exercise of judgment concerning the merits of the petition.

words "Seat Belt." Also, in 77,549 Buicks for the model years 1974 through 1977 the word "Belt" appeared in the singular rather than the plural in the display "Fasten Seat Belt." The notice described GM's argument:

With respect to the first noncompliance [GM] argued that its omission of the word "Fasten" did not degrade the information transmitted to the vehicle occupants, and that the words "Seat Belt" by implication instruct the operator to fasten his belt. "There is no other reasonable interpretation that the driver would be expected to give the message." As for its omission of the plural "s", GM noted that the initial NHTSA proposal was "Fasten Seat Belt" and that there was no explanation in the preamble of the final rule to explain the change from the singular to the plural, which, in GM's view, indicated "that in this instance, there is a distinction without a real difference."

On September 28, 1978, the NHTSA published a notice proposing to amend the definition of "designated seating position" to "clarify in dimensional terms that the definition includes any position likely to be used for seating accommodation while the vehicle is in motion" (Docket 78-13-Notice 1; 43 FR 44556). Notice 14 issued on November 13, 1978, was a final rule allowing automobile manufacturers the option to use alternatives to latches in releasing occupants from passive belt systems. The rule was aimed at encouraging belt use by motorists.

Finally, on February 5, 1979, FMVSS 208 was corrected by the addition of section 7.1.3—a chart on weights and dimensions of vehicle occupants—and section headings for paragraph S7.

Technological Development and Testing, 1976-1978

Technological development and testing continued from 1976 into 1978. In particular, research was aimed at passive protection for small cars, solving the problem of out-of-position occupants, especially children, and developing adequate protection at speeds up to 45 mph.

Minicars, Inc., worked on an air bag system for the small car driver and found that problems still existed. A December 1976 progress report described sled tests using 50th-percentile dummies in 30-mph barrier impacts, which "were unsuccessful in meeting criteria of Federal Motor Vehicle Safety Standard (FMVSS) 208, in spite of various improvements made to the air cushion, column, and seat." The final report concluded:

The sled test results . . . indicated that at the 30 mph test velocity dummy injury measures would be within the FMVSS 208 injury criteria for all but the following occupants:

1. Passengers represented by the 95th percentile male dummy, in the so-called normally seated position, and

2. Child passengers represented by the 6-year old dummy, in the proximity of the dash (out-of-position) at vehicle impact. 47/

Dynamic Science evaluated small car restraints in car-to-car crashes at various angles 48/ and Calspan continued its development of an aspiration inflation technique for use in subcompact cars. A Calspan report of June 5, 1977, describing sled tests at up to 47 mph found "results were generally acceptable although the chest results for the adult 50th percentile male dummies were borderline." This same series of tests also dealt with the out-of-position child. The final report of March 1978 concluded that the aspirated air bag system created "a much safer crash environment to a small child than if the child were to be unrestrained. This statement holds for the child in a normally seated position." As had an earlier Calspan report, this study noted that forces on the out-of-position child were sensitive to the geometry of the vehicle interior and air bag system, but that it appeared "that the system [could] be made innocuous to the out-of-position child. . . ." 49/

Meanwhile, a Minicars, Inc., project was developing advanced solid propellant inflation techniques for subcompact car passenger restraint systems, including testing for effects on the out-of-position child. A number of developmental problems were encountered in the testing. A January 1977 progress report described experiments with the inflator propellant charge and noted that in 10 dynamic out-of-position child tests using a 6-year-old child dummy, FMVSS 208 injury criteria were not met. Later in 1977, two tests using a normally seated child dummy failed. In one, gas leaked from the inflator and burned a hole in the air bag; in the second, the inflator functioned normally but the child dummy slid off the seat. 50/

Evaluation testing of the GM Air Cushion Restraint System continued into 1977, and results were generally encouraging. 51/ Continuing studies at higher speeds with subcompact cars, however, indicated the need for further testing. Southwest Research Institute tested dummies in impacts varying from frontal to 30° oblique, at velocity changes from 17 to 50 mph. The results indicated that "the

47/ Minicars, Inc., "Small Car Driver Inflatable Restraint System Evaluation," Progress Report, December 2, 1976; and Final Report, Vol. IV, "Evolving a Low Mount Passenger Air Cushion Restraint System (ACRS) for Vega Subcompact Vehicle" (DOT Contract HS-6-01412).

48/ Dynamic Science, Inc., "Vehicle Integration and Evaluation of Passive Small Car Restraint System" (DOT Contract HS-6-01307).

49/ Calspan Corp., "Development of the Aspiration Technique for Subcompact Cars - Front Seat Passenger," 1977 and "Front Seat Passenger Aspirator Air Bag System For Small Cars - Phase II Evaluation. Final Report," March 1978 (DOT Contract HS-5-01254).

50/ Minicars, Inc., "Development of Solid Propellant Inflation Technique for the Subcompact Car Passenger Restraint System," Progress Report, January 1977 (DOT Contract HS 6-01384).

51/ Calspan Corp., "Evaluation Test of GM Air Cushion Restraints," 1977 (DOT Contract HS-5-01017).

occupant protection provided by the improved driver restraint system [was] marginal at 50 mph and depend[ed] upon impact direction and occupant size; the greater the obliquity of the impact direction from frontal, the greater the injury potential and the larger the occupant size, the greater the injury potential." 52/

Pacific Legal Foundation/Ralph Nader vs.
Department of Transportation

On September 1, 1977, the Pacific Legal Foundation (PLF) filed suit against the DOT contesting Secretary Adam's final ruling of June 30, 1977, and requesting that it be set aside. Ralph Nader and Public Citizen filed suit on January 13, 1978, challenging instead the Secretary's decision to delay and phase in the standard, requesting that implementation be speeded up. In addition, shortly after the cases were consolidated on January 25, 1978, Ford was allowed to intervene as an "interested party," supporting the Secretary's timetable and phase-in against the Nader suit. The court heard arguments on the case on November 21, 1978, and handed down its decision on February 1, 1979. It dismissed the arguments of both petitioners, affirming the Secretary's ruling.

PLF Argument

The PLF's first arguments were offered to support its claim that the "Mandating of 'Passive' Restraints on the Existing Record was Arbitrary, Capricious, and Contrary to the Requirements of the National Traffic and Motor Vehicle Safety Act." These arguments were presented as follows:

1. The DOT's estimates of air bag effectiveness were not based on field data, but only on experimental studies: "DOT's statement that air-bag field data confirm (and in fact exceed) the effectiveness estimates is contradicted by a number of independent studies in the record." The NHTSA itself had admitted that more fatalities than would have been predicted had occurred in accidents involving air bag-equipped cars (4 fatalities in 295 incidents). To underscore the necessity of reliable, field-derived data, and the "potential for disaster" when it is not obtained, PLF pointed to the case of FMVSS 121, where "not until the occurrence of scores of accidents, involving over eighteen fatalities, did the Secretary of Transportation call for a partial moratorium on enforcement of the standard." Thus, the imposition of passive restraints was "clearly unjustifiable."
2. The DOT had arbitrarily assumed that lapbelt use would remain unchanged in air bag-equipped cars, when in fact "people will tend to use their lapbelts less, if at all," thereby lessening the air bags' effectiveness. NHTSA statistics indicated that "the belt-use rate in

52/ Southwest Research Institute, "Performance Testing of an Improved Driver Restraint System for Subcompact Cars," Vol. 2, Final Report, 1977 (DOT Contract HS-4-00933).

air-bag equipped cars was approximately half that in comparable non-air bag cars." This decline would not only lessen the effectiveness of air bags, but would "lead to injuries and deaths which would otherwise not have occurred." In addition, the PLF argued that the NHTSA had misled the public in its promotional literature, implying that seatbelts were not necessary in air bag-equipped vehicles.

3. The DOT, arbitrarily and contrary to statute, had failed to consider public opinion. Secretary Coleman's explicit concern over possible adverse public reaction to FMVSS 208 had been rejected in Secretary Adams' ruling. The PLF argued that the Safety Act of 1966, in demanding reasonableness and practicability, required such concern: "Air bags are a device whose effectiveness is critically dependent on public reaction in terms of lapbelt use, replacement after deployment, and willful deactivation. The failure to consider public reaction in predicting air bag effectiveness is clearly erroneous and unjustifiable. . ."

The PLF's argument then turned to potential risks of air bags, declaring that "the issuance of a 'safety' standard which itself imposes substantial risks on those who might otherwise not be subject to them was beyond DOT's authority." In particular, the PLF focused on the possible dangers of an estimated 7,000 annual inadvertent air bag deployments.

Finally, the PLF argued that requiring passive restraints was an "unconstitutional infringement of individual rights of privacy." Noting again some of the potential risks of air bags, the PLF declared, "The result of this dictate will not be mere inconvenience, irritation, or expense; it will be the literal subjugation of individuals to risks of life and death. . . ."

Ralph Nader and Public Citizen Argument

Nader argued that he strongly supported FMVSS 208 but believed that Secretary Adams had "committed a serious error in extending the effective date one year [to September 1, 1981]. . . and that he compounded that error by adding a phase-in over three model years. . . ." Nader requested that the court set aside the Secretary's implementation dates, directing FMVSS 208 to become effective in all cars on September 1, 1980. He presented his case in three major arguments:

1. The Safety Act directed that regulations become effective within 180 days to 1 year, unless "good cause" had been shown for extension. Nader argued that the Secretary had shown no good cause for setting back the effective date from 1980 to 1981. The Secretary had disregarded not only the long history of air bag development, which had shown the restraint to be feasible, but had ignored his own staff's recommendations. In addition, there could not be "great hardship" to the automobile industry caused by air bags, since passive belts were an allowed option under the final rule.

2. FMVSS 208's 3-year phase-in based on wheelbase length was neither authorized nor reasonable. Nader argued that while the Safety Act allowed standards to be applied differently according to vehicle "type," passenger cars, regardless of size, constituted one type and thus could not be phased in. In addition, a safety standard should apply to everyone, Nader declared: "If a DOT passenger car standard works, everyone has it, and if not, no one does." Finally, small cars, for which FMVSS 208 was mandated last, were most in need of protection. The reasons given for the phase-in, Nader concluded, "showed undue concern for convenience to the manufacturers over risks to motorists. . . ."
3. Finally, Nader argued that "the Secretary, in making his decision, included as a significant factor in his calculus the possibility that Congress might act to override his judgment." For this reason, it must be set aside. Moreover, the Congressional veto provision regarding air bags (included in the 1974 amendment to the Safety Act outlawing interlock systems) was unconstitutional.

Ford Intervenor Argument

Ford, in an intervenor's brief, supported the FMVSS 208 phase-in schedule, contesting only the Nader argument. Nader was incorrect, Ford declared, in maintaining that the 4-year leadtime was excessive because automobile manufacturers have known for years that passive restraints would be mandated. On the contrary, "the bulk, duration, and meandering course of this extended rulemaking proceeding" had made the future of FMVSS 208 extremely uncertain. Just 6 months after Secretary Coleman had decided on one policy, Secretary Adams decided on another.

Ford also argued that Nader was in error stating that the leadtime was excessive because passive belts could easily be installed in all cars. Passive belts, Ford pointed out, could not be used in three-passenger front bench seat vehicles.

Ford then addressed directly Nader's arguments, maintaining that the Secretary's authority to order a 3-year phase-in was supported by the language and legislative history of the Safety Act, as well as by established agency practice, and that the 3-year phase-in ordered by Secretary Adams was a rational choice supported by substantial evidence.

DOT Argument

After a summary of the history of FMVSS 208, the DOT responded to the PLF's arguments. In particular, the DOT's arguments were to "demonstrate that the decision to mandate passive restraints was not only rational, but, in the circumstances, compelling."

1. FMVSS 208 did meet the needs of motor vehicle safety. The DOT reiterated that seatbelts, while effective, go unused, and cited the Chrysler case of 1972, in which the court recognized the ineffectiveness of seatbelts as used and supported the need for

mandatory passive restraints. The DOT noted that since the Chrysler case "over \$100 million [had] been devoted to research and development of passive restraints systems [including] 1700 proving ground crash tests." Test results had shown air bags to be reliable and effective, and real-world data, while limited, was "for the most part positive."

2. As it did in the Chrysler case, the DOT argued that it had been given the authority to mandate regulations in order to spur technological development for safety needs. A reliance on experimental testing was thus necessary, and in this case was conclusive enough to warrant mandating the standard.

Furthermore, the DOT declared that estimates of air bag effectiveness were not repudiated by field experience. The studies cited by the PLF had been carefully considered by the Secretary and found to be "flawed in their methodology." In addition, the real-world data available so far were clearly too limited for statistical analysis.

3. DOT denied the remainder of the PLF's allegations by arguing that it had not arbitrarily assumed that seatbelt use would remain unchanged, but had considered this in effectiveness estimates. Furthermore, air bag systems did not create unreasonable hazards; both inadvertent deployment and sodium azide constituted small risks. A consideration of public reaction was not a "decisive statutory factor," and, in any event, the Secretary had considered public opinion. Finally, FMVSS 208 "[did] not unconstitutionally infringe on individual rights of privacy."

The DOT then turned its attention to Nader's arguments, denying the challenge to the standard's effective date and phase-in schedule.

1. The DOT defended the effective date of September 1, 1981, as a reasonable leadtime for industry. Part of its rationale, it added, was to encourage the installation of air bags over seatbelts as a passive restraint solution:

If . . . decreasing the lead time would result in the use of passive belt systems in a significant portion of the new cars produced, the clear cut safety advantages of the air bag system would be denied to a large segment of the public.

2. The Secretary did have authority to order a phase-in and the method he ordered was rational. The staggered introduction of the standard met the need for practicability; and wheelbase length was an accepted criterion for distinguishing automobile "types." Small cars do need the most protection, but were phased in last because they "presented certain 'packaging problems' which [were] likely to be resolved as the industry obtain[ed] greater experience with the systems."

3. The DOT denied Nader's allegation that the FMVSS 208 decision was influenced by consideration of a possible Congressional veto, declaring that he had shown no proof of such influence. The DOT concluded by stating that "the issue of the constitutionality of the legislative veto provisions in the Safety Act [was] not before the court."

Court Ruling

Except on several minor issues, the court agreed with the DOT's defense against both the PLF and Ralph Nader. The Secretary's order was thus affirmed, and FMVSS 208 was left to stand as issued on June 30, 1977.

PLF Case

The court ruled that substantial evidence did support passive restraints and that the Secretary's decision to mandate them was rational. The court cited supportive studies noted in the Coleman and Adams decisions, reiterated the need for reliance on experimental simulation in order that the NHTSA may "push the automobile industry beyond present engineering capabilities. . ." and agreed that the real-world data were too limited to be conclusive. The court did point out, however, the need for the DOT to "monitor closely the road experience with any standard based on experimental data and make needed modifications," noting the agency's failure to do so in the FMVSS 121 case.

The court ruled that Secretary Adams had "adequately justified his action in terms of the anticipated public reaction." However, it agreed with the thrust of the PLF's argument, declaring, "We believe that the agency cannot fulfill its statutory responsibility unless it considers popular reaction."

Relating two additional PLF arguments to the issue of public opinion, the court dismissed as insubstantial the PLF's allegations that the Secretary had failed to consider deactivation of passive systems and that air bags would deter use of seatbelts.

Against PLF's claim that air bags present collateral dangers to the motorist, the court repeated a former ruling, stating that the NHTSA "must of necessity consider many variables, and make 'trade-offs' between various desiderata in deciding upon a particular standard." In particular instances of inadvertent deployment, out-of-position passengers, and sodium azide, the court concluded that the Secretary had not "abused his discretion in assessing the trade-offs between the expected benefits and the potential dangers of airbags."

Finally, the court dismissed in a footnote the PLF's contention that FMVSS 208 violated the right to privacy. It concluded that FMVSS 208 was "a reasonable exercise of the Government's authority to guard our citizens' health and safety."

Nader Case

Against the Ralph Nader and Public Citizen argument that the Secretary had not shown "good cause" for extending the effective date of FMVSS 208, the court

ruled that good cause had been shown. The NHTSA, it wrote, "must reconsider the abilities of producers to comply with the new requirement and of the public to grasp the need for the change."

In addition, the court found no basis in the argument against phase-in by wheelbase length. Against the allegation that the phase-in was improperly adopted to avoid Congressional veto, the court ruled that in the absence of concrete evidence, it would accept the Secretary's reasons for his decision. It also declined to consider the constitutionality of the legislative veto in a case in which Congress had not exercised it.

Subsequent to the court ruling, the PLF filed a petition requesting a rehearing. This petition was denied on March 5, 1979. The PLF has since petitioned the U.S. Supreme Court for review of the case. The Supreme Court had not acted on the petition as of the date of this report.

Recent Developments Related to FMVSS 208

In the course of the PLF's suit against the DOT, the PLF had requested from the NHTSA, under the Freedom of Information Act, Dr. Charles Kahane's April 1976 study entitled "Statistical Analysis of Air Bag Deaths." The paper had not previously been disclosed to the public. Though the request was at first denied, the NHTSA released Dr. Kahane's analysis in September 1978. A press statement which accompanied release of the study declared that "the conclusions of the paper were judged to be essentially meaningless because of the gross inadequacy of the underlying data." The NHTSA stated that it had decided to make the report available "on the grounds that to continue to withhold it would lend the document an aura of credibility that it does not deserve."

At the same time that the Kahane paper was disclosed, the NHTSA released "An Analysis of Fatalities in Cars Equipped With Air Bags" (September 1978), a new study which refuted Dr. Kahane's conclusions. The analysis utilized data from the NHTSA's Fatal Accident Reporting System (FARS). Fatalities in GM air cushion-equipped cars were compared with fatalities in 1974-1976 full-size and luxury Buicks, Oldsmobiles, and Cadillacs sold to the general public. The effectiveness of the air cushion restraint system in preventing fatalities was calculated to be 45 percent.

Another analysis of real-world accident data was made by NHTSA's Conrad Cooke in "Fatality Rate Comparison, With and Without Air Bags" (February 14, 1979). Air bag system effectiveness was computed using vehicle exposure years rather than vehicle miles traveled, as the September 1978 paper had done. Cooke concluded:

The fatality rates of air bag cars are lower by approximately 1/2 for the privately owned ACRS [GM Air Cushion Restraint System] cars and by approximately 1/3 for total of all air bag cars as compared with equivalent cars with regular [seat] belts.

Another paper by Cooke dated March 28, 1979, "Injury and Fatality Rates, With and Without Air Bags," again calculated air bag effectiveness using newly available data from the National Crash Severity Study. The results of this analysis in general agreed with the estimates made in the September 1978 and February 1979 papers. Cooke concluded:

The preliminary data . . . indicates that air bag car occupants receive 40 percent less AIS [Abbreviated Injury Severity Scale] 2 moderate injuries, 44 percent less AIS 3 and 4 severe or serious injuries, and 53 percent less AIS 5 and up critical and fatal injuries.

In 1978, the NHTSA began publishing an "Occupant Protection Program Progress Report." The first was issued on August 30, 1978. In addition to describing such topics as the state of industrial preparedness for passive restraints and NHTSA efforts to increase usage of safety belts, the paper reported the results of an NHTSA commissioned survey, "Public Attitudes Toward Passive Restraint Systems," by Peter D. Hart Research Associates (Summary Report, August 1978). The study indicated that only one-quarter of the population reported using seatbelts all or most of the time, and that seatbelts were perceived to be uncomfortable and difficult to use. The survey found that "the public rates air bags above automatic or active belts for their safety protection, comfort, appearance, and ease of use." By a two-to-one margin, those surveyed believed that the government should require automatic crash protection rather than encourage seatbelt use, and when asked to choose between air bags and automatic belts, respondents divided their preference with price being only a marginal consideration.

The NHTSA published a second, more lengthy progress report in April 1979. The report summarized the results of the NHTSA's two recent analyses of air bag effectiveness based on accident data, "Fatality Rate Comparison, With and Without Airbags," and "Injury and Fatality Rates, With and Without Air Bags" (noted above). It also described several additional occupant restraint reports. Volkswagen Rabbits equipped with passive (now called "automatic") belts were found to have a fatality rate half that of Rabbits equipped with manual belts. An ongoing survey of seatbelt usage by Opinion Research Corp. reported the overall usage rate in the U.S. as of June 1978 to be 14 percent. Another report evaluated the comfort and convenience of safety belts in 1979 model cars, identifying a number of problems in the design of belt systems. The NHTSA reported that it "intends to initiate rulemaking in the next several months on these matters."

The NHTSA also described in its 1979 Progress Report its public information programs, the state of restraint system technology, and the readiness of the automotive industry to offer the restraints in production vehicles. It noted work by Batelle Columbus Laboratories and Arthur D. Little, Inc., "to identify potential problems associated with sodium azide use in air bag inflators." The report also discussed insurance savings and product liability, stating,

A safety device which reduces deaths and injuries by about one-third, will ultimately reduce insurance costs and premiums

related to personal injury by about one third. At current insurance costs, this would near about \$50 per insured vehicle per year.

The report concluded that "manufacturers, dealers and suppliers do not face an increased overall risk of liability because of the use of automatic restraints."

Shortly after the Adams decision a number of medical, insurance, and public interest groups formed the National Committee for Automobile Crash Protection. The purpose of the group was to support the Secretary's ruling, particularly against the repeal measures introduced by Representative Shuster and Senator Griffin. The organization, which has since grown to include over 60 participating groups, included among its initial members the Aetna, Allstate, Nationwide, and State Farm Insurance Companies; the American Academy of Pediatrics; the American Congress of Rehabilitation Medicine; the American Nurses Association; the Center for Auto Safety; Consumer Action Now; Ralph Nader; and the United Automobile, Aerospace, and Agricultural Implement Workers of America (UAW).

In addition, the IIHS under its president, Dr. William Haddon, continued its active support of passive restraints and the NHTSA's rulemaking. In June 1978, the IIHS published a "Background Manual on the Occupant Restraint Issue." The booklet brought together information on passive restraints and air bags, including editorials, articles and comments supportive of FMVSS 208.

National Transportation Safety Board Evaluation

In 1978, the U.S. Senate Committee on Appropriations requested that the National Transportation Safety Board "review and assess the adequacy of the National Highway Traffic Safety Administration's plan for evaluating the effectiveness of passive restraints." ^{53/} On March 16, 1979, the Safety Board responded to this directive, publishing an analysis of the NHTSA's passive restraint evaluation program. ^{54/}

The Safety Board's report concluded that "the NHTSA is committed to evaluating the passive restraint standard, but the current evaluation program is unorganized." The Board found that "there [was] no master plan which identifie[d] the integral elements of the evaluation program or specifie[d] a timetable for their completion." Consequently, the Safety Board adopted a recommendation that the NHTSA:

Develop and publish a formal evaluation plan to effectively manage the NHTSA evaluation activities related to the passive restraint standard (FMVSS 208 as amended July 5, 1977). As part of its development, the proposed plan should be published for public comment by October 1, 1979. . . .

^{53/} 1979 Appropriation Bill for the Department of Transportation and Related Agencies, Senate Report No. 95-938.

^{54/} National Transportation Safety Board, "Safety Effectiveness Evaluation of the NHTSA's Passive Restraint Evaluation Program," March 16, 1979 (NTSB-SEE-79-3).

In its April 1979 Progress Report, the NHTSA indicated that it was reviewing the recommendations of the Safety Board and would publish a detailed evaluation plan by the fall of 1979.

The General Accounting Office Report

On July 27, 1979, the General Accounting Office (GAO) published "Passive Restraints for Automobile Occupants—A Closer Look." The purpose of the report was to

provide the Congress with information on the [DOT's] effectiveness and cost estimates for mandated [passive restraint] systems as well as the potential health and safety hazards associated with the use of sodium azide in air bag systems.

The study analyzed four issues — passive restraint effectiveness, sodium azide, cost of air bags, and insurance premium discounts.

The GAO analysis concluded that, while "passive restraints offer life-saving and injury-prevention potential," the NHTSA estimates of their effectiveness gave "a degree of certainty not fully supported by the test data." The GAO pointed out the limited testing on passive belts and potential danger to out-of-position occupants, particularly children. The report recommended additional testing, for out-of-position children, as well as the appointment of a task force to develop a comprehensive evaluation program of real-world performance of passive restraints.

The study further concluded that "many questions are unanswered concerning the health and safety risks of using the chemical sodium azide to inflate air bags." It recommended that both the Environmental Protection Agency and the Occupational Safety and Health Administration "require that high priority be given to having additional research done on sodium azide to measure its health and safety risks." Finally, though no specific recommendations were made, the GAO found the NHTSA's estimates of air bag cost and insurance savings to be optimistic. Regarding the former, the report concluded that the NHTSA's "\$112 air bag cost estimate does not reflect increased costs that will come with lower production volumes [because of probable increased use of passive belts.]"

The NHTSA commented at length on a draft of the GAO report. The agency's response was included as an appendix to the GAO study, and was accompanied by comments made in rebuttal by the GAO.

FMVSS 208: The Existing Standard

The following general description of the standard is presented to summarize the requirements of FMVSS 208 as they exist at this time:

- o The standard applies to passenger cars; multipurpose passenger vehicles, trucks, and buses. However, the rule as it is currently written contains mandatory passive restraint requirements only for passenger cars.

- o Passenger cars are given a number of options for the period until 1983. The option currently offered in most vehicles includes a lap-shoulder belt combination in front outboard seating positions, and lapbelts in all other positions.
- o Mandatory passive requirements are to be phased in starting in 1981. By September 1, 1983, all passenger cars will be required to provide occupant protection as follows:
 - a. All front seat occupants must be provided with passive protection which will meet the requirements of the frontal crash test. Automobile manufacturers are then given the option of offering front seat passengers: 1) passive protection which will meet the requirements of the lateral and rollover tests, or 2) seatbelts which meet the requirements for a frontal barrier crash test, as well as passive protection.
 - b. A lapbelt or lap-shoulder belt combination is to be provided for each rear seat occupant.
- o Vehicles are tested in three crash modes (frontal crash, lateral crash, and a rollover test) using instrumented anthropomorphic test dummies to measure injury levels.
 - 1. In the frontal crash the vehicle is crashed into a barrier at 30 mph. The barrier may be perpendicular to the vehicle's direction of travel or at any angle up to 30 degrees. The test dummy must not be ejected from the vehicle and must meet the injury criteria for the head, chest, and femur.
 - 2. In the lateral test, the vehicle is impacted on the side by a barrier moving at 20 mph; and the test dummy must meet the injury criteria for the head and chest.
 - 3. In the rollover test, the vehicle is mounted on an angled platform and moved laterally at 30 mph and rapidly decelerated causing the vehicle to be ejected from the platform and roll over. In this test all portions of the test dummy must remain within the passenger compartment. No other injury criteria are specified.
- o The standard specifies the exact positioning of the test dummies within the vehicle as well as the conditions under which the vehicle is to be tested. For example, doors must be fully closed and latched but not locked.

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